Rocky Mountain Remediation Services, L.L.C

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ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

FINAL SAFETY ANALYSIS REPORT

BUILDING 991 COMPLEX

RMRS ORC Review: Meeting 99-45
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REVIEW AND APPROVAL

FOR

BUILDING 991 COMPLEX FINAL SAFETY ANALYSIS REPORT (FSAR)

September 1999

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EXECUTIVE SUMMARY

This document satisfies the requirement in Department of Energy (DOE) Order 5480.23, *Nuclear Safety Analysis Reports* (Ref. 1), to develop a Final Safety Analysis Report (FSAR) and includes Technical Safety Requirements (TSRs) that were prepared in accordance with DOE Order 5480.22, *Technical Safety Requirements*, (Ref. 2) and the *Document of Example Technical Safety Requirements, Volume 1* (Ref. 3). This FSAR is intended to meet a similar requirement in the anticipated Nuclear Safety Rule, 10 CFR 830.110, *Safety Analysis Report* (Ref. 4). This FSAR was prepared in accordance with the DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans* (Ref. 5), DOE-STD-1027-92, *Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports* (Ref. 6) and DOE-STD-3009-94, *Preparation Guide for U. S. Department of Energy Non-reactor Nuclear Facility Safety Analysis Reports* (Ref. 7), as the implementing standards for DOE Order 5480.23.

Per the referenced DOE regulatory documents, the purpose of a FSAR is to provide the authorization basis upon which safe operations of a nuclear facility are based. Annual updates of this FSAR will be prepared per DOE Order 5480.23.

FACILITY BACKGROUND AND MISSION

The Building 991 Complex was one of the first sets of facilities built at the Rocky Flats Environmental Technology Site (Site) in the early 1950's. The first mission of the complex dealt with assembly, shipping, and receiving final weapons components in support of the DOE Complex weapons production mission. The original facility use also included many other aspects of weapons production such as administrative support, product inspection, research and development, and material storage. In the early 1960's, the Building 991 Complex supported beryllium coating operations and materials testing. The mission continued to change in the mid-1970's to a storage, receipt, and shipping facility for various materials. In the mid-1980's, a new dock was added to the complex for the off-site shipment of Special Nuclear Material (SNM) via Safe Secure Transport (SST) vehicles.

The Building 991 Complex currently supports the Site as a storage and staging facility for various waste and product containers. The waste containers that are stored in the complex, until removal from the Site, include: Pipe Overpack Containers (POCs, 55-gallon drums) which contain repacked plutonium residue materials; Transuranic (TRU) waste containers (55-gallon drums and metal waste boxes) which contain a variety of non-liquid, contaminated wastes; and Low-Level Waste (LLW) containers (55-gallon drums, metal waste boxes, and wooden waste crates) which contain a variety of non-liquid, low-level contaminated wastes. The complex also serves as a depot for the removal of Category I and II SNM containers from the Site. The Building 991 Complex receives these SNM Type B shipping containers from various facilities at the Site and stages the containers for a period of time until they are loaded on SSTs for removal from the Site. The complex also houses building management personnel, operations involving maintenance and repair of Site-wide alarm systems, metallography laboratories, Radiation Control Technicians (RCTs), and the nondestructive testing department.

FACILITY OVERVIEW

The Building 991 Complex is located on the east side of the developed portion of the Site within the Protected Area. The complex is composed of several facilities of which Building 991 is the main building. Four buildings are connected to Building 991 and are underground vaults. These buildings are: (1) Building 996 which is connected to Building 991 via Corridor B; (2) Building 997 which is connected to Corridor B via Corridor C and is prohibited from container storage by the TSRs; (3) Building 998 (also called Room 300) which is connected to Building 991 via Corridor A; and (4) Building 999 which is connected to Corridor C and is also prohibited from container storage. Four other major buildings are within the complex: (1) Building 984 which is a warehouse-type facility used for storing empty shipping containers and contains a drum crushing operation; (2) Building 985 which is the Heating, Ventilating, and Air Conditioning (HVAC) plenum building supporting Building 996, Building 997, and Building 999; (3) Building 989 which is the standby power diesel generator facility; and (4) Building 992 which is a normally unoccupied guard facility. All of the above ground facilities are located in a depression (*i.e.*, below surrounding landscape) except for Building 985 which is located near the top of the north rise above Corridor B and Building 996.

FACILITY HAZARD CLASSIFICATION

The Building 991 Complex was previously classified as a moderate hazard facility per DOE Order 5481.1B (Ref. 8) and a nonreactor nuclear facility per DOE Order 5480.5 (Ref. 9). Based upon the inventory of radionuclides present during the accomplishment of the new mission of the Building 991 Complex, the complex is now classified as a Hazard Category 2 nuclear facility in accordance with the inventory thresholds defined in Attachment 1 of DOE-STD-1027-92.

SAFETY ANALYSIS OVERVIEW

An activity-based hazards identification and evaluation of the Building 991 Complex was performed to identify, evaluate, and control hazards associated with SNM and waste container receipt, storage or staging, transfer and shipping operations. The hazard identification process identified 44 hazards or energy sources in the Building 991 Complex. Of these, 22 hazards or energy sources were determined to be standard industrial hazards that were to be controlled by the Site Safety Management Programs (SMPs) and did not require further evaluation. For the remaining 22 hazards/energy sources, the hazard evaluation process determined how each of the hazards or energy sources could lead to a release of hazardous material. The process identified 37 general accident scenarios leading to releases due to failures of radioactive material containers. These 37 general accident scenarios could be grouped into seven accident scenario categories. The seven postulated accident categories initially considered for evaluation were (1) material fires (*i.e.*, pyrophoric material fires); (2) facility fires; (3) spills; (4) punctures, (5) container explosions (*i.e.*, internal hydrogen explosions); (6) facility explosions; and (7) criticality events.

Each of the 37 general accident scenarios were evaluated for each of the identified radioactive material containers (*i.e.*, SNM Type B shipping containers, POCs, TRU waste containers, metal LLW containers, and wooden LLW crates) under each of the general activities to be performed in the complex using a hazard evaluation process consistent with that defined in

DOE-STD-3009-94. The general activities assessed were: characterization, treatment, and disposition of excess chemicals; construction; waste generation (*e.g.*, drum crushing operations, filter change-out); maintenance; receipt, staging, and shipment of SNM; receipt, storage, transfer, and shipment of waste; routine activities (*e.g.*, utility operations, tenant activities); and surveillance. This more detailed hazard evaluation process evaluated 1,480 activity / container / scenario combinations. These 1,480 combinations were reduced down to 164 credible scenario combinations that were examined in the determination of bounding accident scenarios to be carried forward into the accident analysis process.

Twelve accident scenarios were defined in the bounding scenario determination process with subsequent area-specific considerations (*i.e.*, bounding scenarios were examined for further distinction related to location of the scenario in the Building 991 Complex). The scenarios were analyzed to determine frequency of initiating events (including internal, natural phenomena, and external events), the radioactive material releases for scenarios, the consequences of the releases, and the risk to the public (as represented by maximally exposed off-Site individual (MOI)), the collocated worker at 100 meters (CW), and the immediate worker (IW). The postulated accident scenario risk classes (as defined in DOE-STD-3011-94) determined from the analyses credited preventive and mitigative features currently present in the Building 991 Complex.

Postulated accident scenarios found to be Risk Class I (major risk) or Risk Class II (serious risk) were further examined to determine if any preventive or mitigative features exist which, if implemented, could reduce the scenario risk to Risk Class III (marginal risk) or Risk Class IV (negligible risk). These features were noted for inclusion in the control set defined by the TSRs. The risk associated with postulated accidents scenarios found to be Risk Class III or Risk Class IV are low enough to not require further evaluation.

RISK DOMINANT ACCIDENT SCENARIO CONCLUSIONS

As stated above, a total of twelve accident scenarios (nine operational accidents and three natural phenomena accident) were analyzed. Of these twelve scenarios, seven scenario evaluations initially resulted in a Risk Class I or Risk Class II to either the MOI, the CW, or the IW (the puncture scenario had one of its four evaluated cases result in a Risk Class I or II to either the MOI, CW, or the IW). Of the accident scenarios evaluated, none resulted in a MOI radiological dose consequence exceeding 5 rem (the highest MOI radiological dose was 2.6 rem). The highest CW radiological dose consequence was 350 rem for an *extremely unlikely* TRU waste container explosion event.

The accident scenarios yielding Risk Class I or Risk Class II results (shown as shaded areas in the table) are presented in Table 1. The initial risk determinations are presented for each of the receptors as determined during the accident analysis. In some cases, the dominant scenarios were further mitigated by crediting ventilation system high efficiency particulate air (HEPA) filtration, as indicated in the table. For other cases, a more realistic risk class determination for each high risk receptor is also presented with an explanation of the analysis conservatism that was removed.

Based on the information in Table 1, and after analysis conservatism is removed, the highest risk non-operational accident scenario deals with a Design Basis Earthquake (DBE) and yields a Risk Class II to the CW *(unlikely* frequency, *moderate* consequences) and a Risk Class II to the IW *(unlikely* frequency, *moderate* consequences). The highest risk operational accident scenario involves the puncture of two 55-gallon TRU drums. This scenario yields a Risk Class II to the CW (*unlikely* frequency, *moderate* consequences). A container explosion presents the final accident scenario that yielded high risk to a receptor. This scenario resulted in a Risk Class II to the CW (*extremely unlikely* frequency, *high* consequences).

Table 1 Risk Dominant Accident Scenario Results

		INITIAL RISK		RISK AFTER CONSERVATISM REMOVED		
SCENARIO	RECEPTOR	RISK CLASS	FREQ. / CONSQ.	RISK CLASS	FREQ. / CONSQ.	CONSERVATISM REMOVED
1 MW fire involving 3 TRU waste drums	MOI CW IW	II I III	U / 0.26 rem U / 35 rem	III III	U / 0.00026 rem U / 0.035 rem	Consequences reduced crediting a single stage of HEPA filtration.
2 MW fire involving 6 TRU waste drums	MOI CW IW	III II IV	EU / 0.52 rem EU / 71 rem	IV	EU / 0.071 rem	Consequences reduced crediting a single stage of HEPA filtration.
Medium to large fire involving 4 LLW crates	MOI CW IW	III II III	U / 0.0048 rem U / 0.66 rem	III	U / 0.16 rem	More realistic container material-at-risk
Spill involving a pallet of TRU waste drums	MOI CW IW	III I III	A / 0.023 rem A / 3.1 rem	III	A / 0.0031 rem	Consequences reduced crediting a single stage of HEPA filtration.
Puncture of 2 TRU waste drums; dock doors open	MOI CW IW	III II III	U / 0.046 rem U / 6.2 rem	II	U / 3.1 rem	Consequences reduced assuming only a single container punctured.
Puncture of 2 TRU waste drums; dock doors closed	MOI CW IW	III II III	U / 0.046 rem U / 6.2 rem	III	U / 0.0062 rem	Consequences reduced crediting a single stage of HEPA filtration.
Container explosion of 1 TRU waste box dock doors open.	MOI CW IW	III II III	EU / 2.6 rem EU / 350 rem	II	EU / 31 rem	More likely container (drum); more appropriate material modeling assumptions
Container explosion of 1 TRU waste box dock doors closed.	MOI CW IW	III II III	EU / 2.6 rem EU / 350 rem	IV	EU / 0.35 rem	Consequences reduced crediting a single stage of HEPA filtration.
DBE event-induced spill	MOI CW IW	II I II	U / 0.35 rem U / 48 rem	III II II	U / 0.018 rem U / 3.0 rem	More realistic container material-at-risk; Median χ/Q rather than 95[th] percentile.

SAFETY ANALYSIS CONCLUSIONS

The safety analysis in Chapter 4 requires that certain preventive and mitigative controls be maintained. These controls have been developed in Appendix A, *Building 991 Complex Technical Safety Requirements*. The TSRs include three Limiting Conditions for Operation (LCOs) and nine Administrative Controls (ACs). The ACs for the Building 991 Complex are defined by credited programmatic elements and by specific controls/limits identified as Administrative Operating Limits (AOLs). AOLs are specific administrative controls/limits (*i.e.*, the administrative equivalent of a hardware requirement) and are more precise and discrete than administrative controls defined by a SMP or the program attributes of a SMP. The set of

LCOs and ACs for the Building 991 Complex are listed below. AOLs related to ACs are shown following the AC. Seven Design Features (DFs) are also included in the TSRs and are listed below.

Limiting Conditions for Operation

LCO 3.1	Automatic Sprinkler Systems and Flow/Smoke Detection Alarms
LCO 3.2	Filtered Exhaust Ventilation Systems
LCO 3.3	Automatic Plenum Deluge Systems

Administrative Controls

AC 5.1 Organization and Management

AC 5.2 Inventory Control and Material Management

- AOL 1 – POC and waste container shall meet specifications / Wooden LLW crates shall have liners
- AOL 2 – SNM Type B shipping container shall meet specifications / SNM shall be staged in vaults
- AOL 3 – Metal waste containers shall be vented
- AOL 4 – POC, TRU, & LLW containers shall remain below specified radiological material limits
- AOL 5 – Wooden LLW crates shall be stored outside, under sprinkler system, and limited to fifty
- AOL 6 – Containers and storage arrangements shall be compliant with Criticality Safety requirements
- AOL 7 – Pallets of waste drums above a second tier shall be banded
- AOL 8 – An operations control program shall be implemented

AC 5.3 Control of Combustible Materials and Ignition Sources

- AOL 9 – A combustible material and ignition source control program shall be implemented
- AOL 10 – A flammable gas use control program shall be implemented

AC 5.4 Maintenance and Surveillance of SC-3 SSCs

AC 5.5 Emergency Response

AC 5.6 Safety Management Programs

AC 5.7 Fire Protection

AC 5.8 Work Control

AC 5.9 Configuration Management

Design Features

DF 1	Metal Waste Containers/ Drums
DF 2	Pipe Overpack Containers
DF 3	Type B Shipping Containers
DF 4	Building Structure / Internal Fire Barrier [fire rated wall and fire doors separating office area from Room 134]
DF 5	Building Structure / Exterior Walls and Concrete Roofs
DF 6	Building Structure / Hallway Floor
DF 7	Compressed Gas Cylinders

Operation of the Building 991 Complex in conformance with this authorization basis assures there will be no undue risk to workers and the public.

References

1 *Nuclear Safety Analysis Reports*, **DOE Order 5480.23**, U. S. Department of Energy, Washington, D.C., April 30, 1992.

2 *Technical Safety Requirements*, **DOE Order 5480.22**, U. S. Department of Energy, Washington, D.C., 1992.

3 *Document of Example Technical Safety Requirements, Volume 1*, Defense Programs, U. S. Department of Energy, Washington, D.C., November 1993.

4 *Safety Analysis Report*, Code of Federal Regulations, **10 CFR 830.110**, U. S. Department of Energy, Washington, D.C., 1995.

5 *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*, **DOE-STD-3011-94**, U. S. Department of Energy, Washington, D.C., November, 1994.

6 *Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, **DOE-STD-1027-92**, U. S. Department of Energy, Washington, D.C., December, 1992.

7 *Preparation Guide for U. S. Department of Energy Non-reactor Nuclear Facility Safety Analysis Reports*, **DOE-STD-3009-94**, U. S. Department of Energy, Washington, D.C., July, 1994.

8 *Safety Analysis and Review System*, **DOE Order 5481.1B**, U. S. Department of Energy, Washington, D.C., September, 1986.

9 *Safety of Nuclear Facilities*, **DOE Order 5480.5**, U. S. Department of Energy, Washington, D.C., September, 1986.

ACRONYMS

AB	Authorization Basis
AC	Administrative Control/Alternating Current
ACI	American Concrete Institute
ALARA	As Low As Reasonably Achievable
Am	Americium
AOL	Administrative Operating Limit
ARCIE	Alarm Radio Communication Instrumentation and Equipment
ASME	American Society of Mechanical Engineers
BDBE	Beyond Design Basis Earthquake
BTU	British Thermal Unit
CAD/CAM	Computer Aided Design/Computer Aided Manufacturing
CAM	Continuous Air Monitor
CAMU	Corrective Action Management Unit
CAPASU	Criticality Alarms and Plant Annunciation System Upgrade
CAS	Criticality Alarm System or Central Alarm Station
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfm	cubic feet per minute
CSOL	Criticality Safety Operating Limit
CW	Collocated Worker
D&D	Decontamination & Decommissioning
DBE	Design Basis Earthquake
DC	Direct Current
DCW	Domestic Cold Water
DIA	Denver International Airport
DOE	Department of Energy
DOT	Department of Transportation
DR	Damage Ratio
EE	External Event
EFCOG	Energy Facility Contractors Group
EMCC	Emergency Motor Control Center
ES&H	Environmental Safety & Health
EPST	Emergency Planning Screening Threshold

EPTR	Emergency Planning Technical Report
ERPG	Emergency Response Planning Guidelines
eU	Enriched Uranium
F	Fahrenheit
FCAP	Facility Capability Assurance Program
FDC	Fire Dispatch Center
FHA	Fire Hazards Analysis
FSAR	Final Safety Analysis Report
ft^3	cubic feet
g	grams
gpm	gallons per minute
H&S	Health & Safety
HAZMAT	Hazardous Materials Team
HEPA	High Efficiency Particulate Air
HP	Health Physics
hp	horsepower
HSP	Health and Safety Practices
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
ICMS	Integrated Chemical Management System
IDC	Item Description Code
IMC	Integrating Management Contractor
ISB	Integrated Site Baseline
ISM	Integrated Safety Management
IW	Immediate Worker
IWCP	Integrated Work Control Program
JCO	Justification for Continued Operations
Jeffco	Jefferson County
kg	kilogram
kV	kilovolt
kW	kilowatt
lbs	pounds

LCO	Limiting Condition for Operation
L.L.C.	Limited Liability Corporation
LLW	Low-Level Waste
LS/DW	Life Safety/Disaster Warning
MAL	Master Activity List
MAR	Material-At-Risk
MCC	Motor Control Center
mJ	millijoule
MOI	Maximum Off-site Individual
MSDS	Material Safety Data Sheet
NA	Not Applicable
NDT	Nondestructive Testing
NFPA	National Fire Protection Association
NMDTR	Nuclear Material Drum Transfer Report
NMSL	Nuclear Material Safety Limit
NPH	Natural Phenomena Hazard
NRC	Nuclear Regulatory Commission
OSR	Operational Safety Requirement
PA	Protected Area
PCB	Polychlorinated Biphenyls
PEF	Plenum Exhaust Fan
PFSSR	Plant Fire/Security System Replacement
PHA	Preliminary Hazard Analysis
PIV	Post Indicator Valve
POC	Pipe Overpack Container
POD	Plan Of the Day
PPG	Plant Procedures Group
PS	Public Safety
PSC	Public Service of Colorado
psf	pounds per square foot
psi	pounds per square inch
psig	pounds per square inch gauge
Pu	Plutonium
QA	Quality Assurance

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QAP	Quality Assurance Plan
RCRA	Resource Conservation and Recovery Act
RCT	Radiation Control Technician
RFFO	Rocky Flats Field Office
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services
rpm	revolutions per minute
RQ	Reportable Quantity
SAAM	Selective Alpha Air Monitor
SAR	Safety Analysis Report
SARAH	Safety Analysis and Risk Assessment Handbook
SC	System Category
SER	System Evaluation Report
Site	Rocky Flats Environmental Technology Site
SIO	Signal Input / Output
SMP	Safety Management Program
SNM	Special Nuclear Material
SR	Surveillance Requirement
SSC	Structure, System, or Component
SST	Safe, Secure Transport
STD	Standard
SWB	Standard Waste Box
TPQ	Threshold Planning Quantity
TQ	Threshold Quantity
TRM	TRU-Mixed
TRU	Transuranic
TRUPACT II	Transuranic Package Transporter II
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage and Disposal
TSR	Technical Safety Requirements
TYP	Ten Year Plan
U	Uranium
UCRL	University of California Research Laboratory
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination

V	Volt
WAD	Work Authorization Document
WEMS	Waste and Environmental Management System
WFC	Waste Form Code
WG	Weapons Grade
WIPP	Waste Isolation Pilot Plant
WS	Worker Safety

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CHAPTER 1

INTRODUCTION

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1. INTRODUCTION

1.1 PURPOSE

This Final Safety Analysis Report (FSAR) provides an authorization basis for the Building 991 Complex (Building 991 and associated buildings). It identifies Technical Safety Requirements (TSRs) necessary to ensure safe operation of the complex. This FSAR demonstrates understanding and adequate control of the Building 991 Complex potential hazards.

Information discussing the Site characteristics necessary for understanding the facility environment are addressed in the Site Safety Analysis Report (SAR) (Ref. 1). The Site SAR addresses such items as Site description, environmental description, natural phenomena threats, external man-made threats, nearby facilities, and validity of existing environmental analyses.

The organization of this FSAR satisfies the format requirements of Department of Energy (DOE) Standard (STD) DOE-STD-3009-94 (Ref. 2) and includes the following chapters:

Chapter 1 — Introduction: Discusses the purpose for this FSAR, identifies the complex mission and authorized activities, and discusses the authorization basis history including past Unreviewed Safety Question Determinations (USQDs) applicable to the complex. A comparison to DOE-STD-3009 content requirements is provided in this chapter.

Chapter 2 — Facility and Systems Description: Provides a discussion of the operational history of the facility, a description of the complex systems and principal equipment housed in the complex facilities.

Chapter 3 — Safety Management Programs: Describes the Site Safety Management System and required Safety Management Programs (SMPs) for the complex. Elements of the SMPs identified in the safety analysis are provided with each SMP.

Chapter 4 — Hazard and Accident Analysis: Presents a summary of the hazard/risk classification methodology, hazard identification, hazard evaluation, accident scenario development methodologies and safety analysis results. Includes a summary table of the accident scenarios analyzed and discusses the risk dominant accident scenarios.

Chapter 5 — Safety Structures, Systems, and Components: Identifies and classifies those structures, systems, and components (SSCs) that ensure the safety functions necessary for safe facility operations. This section provides the safety functions of the SSCs, their boundaries, the support systems required to be operable, the functional requirements, and the performance criteria of the SSC.

Chapter 6 Derivation of Technical Safety Requirements: Explains how the TSRs were developed from the hazard identification and accident evaluation processes and discusses the control types used. This section provides assurances that TSR coverage for the Building 991 Complex is complete.

Appendix A Building 991 Complex Technical Safety Requirements: Presents the TSRs based on the results of the safety analyses documented in Chapter 4.

Appendix B Change Summary: (to be added later as changes are made).

The following table provides a correlation of DOE-STD-3009 chapter requirements to this FSAR for the Building 991 Complex.

Table 1-1 DOE-STD-3009 and Building 991 Complex FSAR Chapter Comparison

DOE-STD-3009 Topic	DOE-STD-3009 Chapter	Building 991 Complex FSAR Chapter and Remarks
Executive Summary	unnumbered	Unnumbered – Facility Background and Mission, Facility Overview, Facility Hazard Classification, Safety Analysis Overview, and Safety Analysis Conclusions are provided in the Executive Summary as identified in DOE-STD-3009. In addition a Risk Dominant Accident Scenario Conclusions is provided in the Executive Summary. The organizations responsible for the Building 991 (B991) design and construction are described in Chapter 2, in association with the physical description of the Buildings, instead of in the Executive Summary. The B991 FSAR organization and management structure is described in Chapter 3 instead of the Executive Summary. The participants involved in the FSAR development process are not mentioned in the Executive Summary but are identified on the review and approval sheet.
Site Characteristics	1	Chapter 1 - B991 FSAR addresses the facility specific items and references the Site SAR, which addresses Site specific items such as Site description, environmental description, natural phenomena threats, external man-made threats, nearby facilities, and validity of existing environmental analysis.
Facility Description	2	Chapter 2 – Operating history of facility, the B991 Complex description, facility buildings and structures, confinement systems, safety support systems (fire suppression system, heating, ventilating and air conditioning (HVAC) system, life safety/disaster warning (LS/DW), lightning protection system, and the building drain system), utility systems, and support facilities (e.g., Building 989) are discussed in Chapter 2. Chapter 1 describes the basic processes (activities) performed in the complex and also provides the types and quantities of hazardous materials identified, flow diagrams of activities, and identifies major interfaces.

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Table 1-1 DOE-STD-3009 and Building 991 Complex FSAR Chapter Comparison

DOE-STD-3009 Topic	DOE-STD-3009 Chapter	Building 991 Complex FSAR Chapter and Remarks
Hazard and Accident Analyses	3	Chapter 4 - Provides a summary of the hazard identification, hazard evaluation, accident analysis, and risk dominant scenarios for the Building 991 Complex. Nuclear Safety Technical Report (NSTR), NSTR-011-98 (Ref. 3) provides the safety analysis for the complex. The NSTR and Chapter 4 identify the requirements for the FSAR. The hazard analysis provides a comprehensive hazard identification and hazard evaluation methodology. The process evaluated the possibility of material fires, facility fires, spills, punctures, container explosions, facility explosions, criticalities, and NPH and external events. Chapter 4 and the NSTR provide the hazard classification of the facility. The hazard evaluation process in the NSTR discusses planned design and operational safety improvements, defense in depth, worker safety, and environmental protection. Controls identified during the hazard evaluation process were incorporated into the TSRs. The hazard evaluation process did credit inherent preventive or mitigative controls that reduced risk to the Maximum Offsite Individual (MOI) and collocated worker (CW), which is different than the DOE-STD-3009 approach of ranking risks from unmitigated scenarios. Accident selection was accomplished in the NSTR by determining the bounding accident scenarios (based on risk). Six different accident types were further analyzed after the hazard evaluation process. Each accident scenario evaluated provided a description of the accident scenario, a discussion on accident frequency, a determination of the material-at-risk (MAR) potentially involved in the accident along with a damage ratio, a determination of accident consequence, and a control set adequacy/vulnerability discussion. DOE-STD-3011 consequence levels were used to determine the risk to the MOI, CW, and immediate worker (IW).
Safety Structures, Systems, and Components	4	Chapter 5 – Safety-class and safety-significant SSCs are discussed in this chapter. This includes a discussion of the safety function, the functional requirements, TSRs, identification of accident scenarios that require the SSC, the system boundaries, and the support systems of the SSC. A system description of the SSC is provided in Chapter 2.

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Table 1-1 DOE-STD-3009 and Building 991 Complex FSAR Chapter Comparison

DOE-STD-3009 Topic	DOE-STD-3009 Chapter	Building 991 Complex FSAR Chapter and Remarks
Derivation of Technical Safety Requirements	5	Chapter 6 and Appendix A – TSR coverage is provided in Table 6-1 and Table 6-2. This table identifies the credited control, its safety function, its control feature (public safety, defense in depth, worker safety), the control type (SC-1/2 or SC-3), the TSR control level (Limiting Condition for Operation (LCO) or Administrative Control (AC)), and the accident scenario that requires the credited control. Derivation of LCOs, surveillance requirements (SRs), and ACs and a discussion of design features is also provided in Chapter 6. A derivation of facility modes is not provided for the B991 Complex. This section was not considered necessary for the FSAR since the mission of the facility if for storage of waste. There are no startup or shutdown requirements for this activity as there are for more complex processes. In addition, no section is provided on interface with TSRs from other facilities. No TSRs from other facilities were identified that affect B991's safety basis.
Prevention of Inadvertent Criticality; Radiation Protection; Hazardous Material Protection; Radioactive and Hazardous Waste Management; Initial Testing, In-Service Surveillance, and Maintenance; Operational Safety; Procedures and Training; Human Factors; Quality Assurance; Emergency Preparedness Program; Provisions for Decontamination and Decommissioning; and Management, Organization, and Institutional Safety Provisions	6 - 17	Chapter 3 – Safety Management Programs (SMPs) are discussed in this chapter. This chapter provides a summary of the SMPs and provides references to the documents or manuals that implement the program. The specificity required by DOE-STD-3009 is not provided in the FSAR. The SMP is being relied on to provide the information required by the standard. The SMPs do not match the DOE-STD-3009 chapter titles exactly.

1.2 COMPLEX MISSION AND ACTIVITIES OVERVIEW

This section lists and describes the activities performed in the Building 991 Complex to provide a fundamental understanding of the facility processes and activities subsequently analyzed in the hazard and accident analyses. The complex mission and activity descriptions also provide the reader with information helpful to understanding the scope of the safety analysis and derivation of the TSRs presented in this FSAR. Credited preventive and mitigative features are described in Appendix A, *Building 991 Complex Technical Safety Requirements*.

The mission of the Building 991 Complex is to support the receipt, storage, transfer and shipment of nuclear materials, transuranic (TRU) waste (includes residues considered as waste), and low-level waste (LLW). The complex mission also includes staging of Category I/II Special Nuclear Material (SNM) for eventual shipment on Safe, Secure, Transports (SSTs). The complex is operated as a tenant facility for the Building Manager, Rocky Mountain Remediation Services (RMRS) Radiation Control Technicians (RCTs), and the Alarm Radio Communication Instrumentation and Equipment (ARCIE) group and includes a metallography laboratory and nondestructive testing (NDT) activities. The future use of the Building 991 Complex and the schedule for its eventual demolition can only be stated in generic terms due to the uncertainties and the range of possibilities for future actions at the Site. It is expected the complex will continue to perform a landlord function and to serve as a waste storage facility without Resource Conservation and Recovery Act (RCRA) units (i.e., no mixed waste storage). The Building 991 Complex storage mission supports the general vision of radioactive waste storage outside of the main plutonium production buildings and management of radioactive waste from building decontamination and decommissioning (D&D). Regardless of the rate of execution or funding, the planned use for the Building 991 Complex, for at least the next four years, is for interim TRU waste (including residues identified as waste) and LLW storage. The actual usage of the complex for storage is dependent on the opening date/rate of disposal at the Waste Isolation Pilot Plant (WIPP) and the rate of generation from residue stabilization and D&D activities. The Building 991 Complex will likely be in service as a radioactive waste storage facility until the last "plutonium" building is demolished and recovered, a new TRU/TRU-Mixed (TRM) facility is constructed, or the volume of TRU waste at the Site is less than the TRU capacity of more advantageous locations (such as Building 664, Building 440, or Building 906). Also, siting of a Corrective Action Management Unit (CAMU) at a future date may involve the removal of the Building 991 Complex (Ref. 4).

Activities conducted in the Building 991 Complex have been grouped into eight types of activities. This grouping permits performing hazard and accident analyses for each activity. It is these eight activities that underwent hazard and accident analyses to evaluate the potential for fire, explosion, spill, criticality and chemical events. The analysis of the Building 991 Complex activities results in the identification of and defines the rationale for the facility-level control set for the continued safe operation of the Building 991 Complex.

Paragraphs 1.2.1 through 1.2.8 identify and describe the Building 991 Complex activities. These activities document those activities authorized prior to preparation and approval of this FSAR. Any new activity for the facility will be screened in accordance with the Unreviewed Safety Question (USQ) process to determine whether an existing, analyzed Building 991 Complex activity bounds the hazards of the new activity. If adequately bounded, the activity could be authorized from a safety analysis standpoint. If not sufficiently bounded, the activity must undergo further safety analysis and the authorization basis (AB) must be updated (i.e., incorporation of a new Building 991 Complex activity and supporting safety analysis).

The Building 991 Complex activities are listed alphabetically with brief process descriptions. Where necessary to understand the process, the process inputs and outputs are

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identified along with the change in materials throughout the process. A summary safety analysis is provided for each activity. A complete hazard and accident analysis of the activity is provided in NSTR-011-98 (Ref. 3) and summarized in Chapter 4. Building 991 Complex activities analyzed during the development of this FSAR include (1) characterization, treatment, and disposition of excess chemicals; (2) construction; (3) generation of waste; (4) maintenance; (5) receipt, staging, and shipment of SNM; (6) receipt, storage, transfer, and shipment of waste; (7) routine activities; and (8) surveillance.

1.2.1 Characterization, Treatment, and Disposition of Excess Chemicals

1.2.1.1 Activity Description

This activity provides the facility with the capability to characterize and dispose of, or to stabilize and neutralize, excess chemicals, which are not going to be used as part of another building Baseline or Mission Program Activity. These chemicals appear on the Building 991 Complex Chemical Tracking Database. Table 1-2 summarizes significant chemical hazards currently in Building 991 that have been targeted for final disposition. Only those chemicals that are present in the facility in significant quantities are identified in Table 1-2. The threshold type and levels of the listed chemicals (Reportable Quantities (RQs) per 40 Code of Federal Regulations (CFR) 302, Threshold Planning Quantities (TPQs) per 40 CFR 355, and/or Threshold Quantities (TQs) per either 29 CFR 1910.119 or 40 CFR 68) are identified in the table along with the quantities and location of the chemical in the facility (Ref. 5, 6, 7, and 8). Removal of excess chemicals from the building will reduce the hazard to the workers and the environment. None of the excess chemicals in the facility exceed TPQs or TQs and therefore no risk to the public is anticipated from any accidental release of the identified chemicals.

Table 1-2 Building 991 Complex Excess Chemicals

Material	Threshold Type	Threshold Level (lbs.)	Quantity (lbs.)	Possible locations
Cumene Hyproperoxide (in adhesive)	RQ TQ	10 5,000	<1	Room 105
Cupric Chloride	RQ	10	25 to 30	Rooms 109, 110
Dibutyl Phthalate (in resin)	RQ	10	5 to 10	Rooms 109, 110
Hydrofluoric Acid	RQ TPQ TQ	100 100 1,000	1 to 5	Rooms 109, 110
Methylene Chloride (in paint removers)	RQ	1,000	45 to 50	Rooms 105, 155
Nitric Acid (worst case 94.5% by weight)	TQ	500	5 to 10	Rooms 109, 110
Potassium Ferricyanide (Potassium Cyanide)	RQ TPQ	10 100	1 to 5	Rooms 109, 110
Sulfuric Acid (pure)	RQ TPQ	1,000 1,000	25 to 30	Rooms 109, 110
Xylene (in caulk)	RQ	100	1 to 5	Rooms 105, 109, 110

1.2.1.2 Safety Analysis Summary

The handling of excess chemicals exposes the workers and the environment to a variety of potential hazards. Potential hazards include the possibility of inhalation, ingestion, and/or absorption of toxic, hazardous, or noxious materials. There are various chemicals in the Building 991 Complex that could present this hazard. Other potential hazards include exposure to unknown or unmarked materials (presently none identified), and exposure to other types of chemical hazards (e.g., batteries). Precautions are required by facility personnel during the performance of this activity. These include ensuring proper procedures are followed during the characterization, treatment, and disposition of any excess chemicals; that personnel are properly trained; Health and Safety Practices are followed; that the material is placed in approved storage locations and is packaged properly; the quantities of chemicals is limited if possible; and that personnel protective equipment is worn as required.

1.2.2 Construction

1.2.2.1 Activity Description

This activity encompasses upgrades of various Building 991 Complex SSCs, modification of various SSCs, removal of fixed SSCs from the Complex, and addition of various SSCs. When construction of specific facility SSCs is required, the Work Control process will be implemented to assess the scope of hazards and define the approach to performing the task. The extent of assessment is graded based upon anticipated involvement with radiological and hazardous materials, and the characteristics of the specific construction activity. Work Control assessment results in a set of controls that are defined in the IWCP package. Operation of any process involving hazardous materials is not authorized through this activity.

1.2.2.2 Safety Analysis Summary

Construction activities predominately involve standard industrial hazards such as high energy equipment, sparking, and compressed flammable gases. Potential hazards associated with this activity include thermal energy (e.g., welding), pressure sources (e.g., compressed gases or hydraulics), and/or kinetic energy (e.g., vehicles, rotating cutting tools). Construction activities may occur in areas used for storage of nuclear materials (e.g., Category I/II SNM, radioactive wastes). Activities are evaluated individually in work packages prior to start of construction. Results of evaluations may dictate that Material-At-Risk (MAR) be removed from construction areas or that implementation of special controls are warranted.

1.2.3 Generation of Waste

1.2.3.1 Activity Description

This activity encompasses the generation of waste in the Building 991 Complex (LLW from filter plenums, potential Toxic Substance Control Act (TSCA) waste (e.g., polychlorinated biphenyls (PCBs)) in the facility, RCRA waste (nickel cadmium batteries in RCRA satellite area), and other types of hazardous waste). The extent of this activity includes removal of materials via a single wooden LLW crate in Building 991, the removal of contaminated filters via a single wooden LLW crate or metal waste crate in Building 985 or from the filter plenum on the roof of Building 991, removal of contaminated drums in two wooden LLW crates or metal crates in Building 984 due to the drum crushing activity, removal of spend nickel-cadmium batteries, removal of PCBs from the transformer inside the facility or from the two transformers outside the facility, and removal of other types of hazardous waste (e.g., lead based paint and asbestos material).

1.2.3.2 Safety Analysis Summary

When generation of any waste is required, the Work Control process will be implemented to assess the scope of hazards and define the approach to performing the task. The extent of assessment is graded based upon anticipated involvement with radiological and hazardous materials, and the characteristics of the specific activity. Work Control assessment results in a set of controls that are defined in the IWCP package. Potential hazards associated with this activity include exposure to radioactive materials (e.g., contamination, High Efficiency Particulate Air (HEPA) filters); kinetic energy (e.g., vehicles); potential energy (e.g., drum crusher); toxic, hazardous, or noxious materials (e.g., spent nickel-cadmium batteries, PCBs, and asbestos); and material handling (e.g., dock, waste crate movements).

Generation of waste activities frequently may be performed near hazardous materials and may introduce hazards and accident initiators (e.g., fires, spills) that would involve the release of MAR. These activities are evaluated in the hazard and accident analyses as to their involvement with hazardous materials and potential accident scenarios. Because generation of waste activities may directly involve hazardous materials, they are conducted under the IWCP, which require specific packages that must be reviewed and approved by appropriate personnel. Specifically, IWCP packages are reviewed for worker hazards by facility health and safety personnel.

1.2.4 Maintenance

1.2.4.1 Activity Description

This activity consists of maintenance, testing and repair of various complex SSCs. This activity could occur anywhere inside or outside of the Building 991 Complex. SSCs potentially involved with this activity include the Heating, Ventilating and Air Conditioning (HVAC) system, the Building 991 utilities (e.g., electrical, water, sanitary, etc.), and the fire suppression, detection, and alarm system.

1.2.4.2 Safety Analysis Summary

When maintenance of any specific facility SSC is required, the Work Control process will be implemented to assess the scope of hazards and define the approach to performing the task. The extent of assessment is graded based upon anticipated involvement with radiological

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and hazardous materials, and the characteristics of the specific maintenance activity. Work Control assessment results in a set of controls that are defined in the IWCP package. Potential hazards associated with this activity include high voltage (e.g., work on or around the 13.8 kilovolt (kV) transformers); radioactive materials (e.g., contamination, waste storage areas); thermal energy (e.g., heaters, diesel generator); pressure sources (e.g., compressed air); kinetic energy (e.g., vehicles); toxic, hazardous, or noxious materials (e.g., use of various chemicals); and material handling (e.g., potential for container movement).

Maintenance activities frequently may be performed near hazardous materials and may introduce hazards and accident initiators (e.g., fires, spills) that would involve the release of MAR. These activities are evaluated in the hazard and accident analyses as to their involvement with hazardous materials and potential accident scenarios. Because maintenance activities may directly involve hazardous materials, they are conducted under the IWCP, which require specific packages that must be reviewed and approved by appropriate personnel. Specifically, IWCP packages are reviewed for worker hazards by facility health and safety personnel.

1.2.5 Receipt, Staging, and Shipment of Category I/II Special Nuclear Material

1.2.5.1 Activity Description

The Building 991 Complex is authorized to receive, stage, and ship Category I/II SNM packaged in certified Department of Transportation (DOT) approved Type B off-site shipping containers. Long-term storage of Category I/II SNM in the Building 991 Complex is <u>not</u> authorized. The AB documents for the Building 991 Complex prohibit any operation involving the opening of a shipping container or repackaging of fissile material containers. On-site receipt and off-site shipment of the Category I/II SNM occurs from the west dock of the Building 991 Complex, which is compatible with SSTs. Once received, the Category I/II SNM is transported to Room 150 and staged until enough containers are received to fill a SST. The Category I/II SNM is continuously attended when it is not secured in Room 150.

The operations associated with the receipt, staging and shipment of Category I/II SNM are performed by personnel outside of Building 991 Complex purview. Facility personnel are notified of pending receipts and shipment but are not authorized to handle the material. Handling is performed by properly trained individuals and all handling is monitored by security personnel. Category I/II SNM will not be opened/repackaged in Building 991.

1.2.5.2 Safety Analysis Summary

Potential hazards associated with this activity include exposure to radioactive materials (DOT Certified Type B containers); kinetic energy (e.g., electric forklift trucks, SSTs); and material handling (e.g., dock, container movement). Transferring of Category I/II SNM involves the physical aspects of material movement. Transfers occur via electric forklift trucks, manual forklift trucks, and hand carts. Material movement takes into account the hazards of transfer, transport procedures and equipment, and personnel training.

Conduct of receipt, staging and shipment of Category I/II SNM may introduce hazards and accident initiators (e.g., fires, spills) that would involve the release of radioactive or hazardous materials. These activities are evaluated in the hazard and accident analyses as to their involvement with hazardous materials and potential accident scenarios. The certified Type B packaging used for the Category I/II SNM is qualified to a free drop test (30-foot drop), crush test, penetration test, immersion test, and a thermal test (30-minute liquid fuel fire).

1.2.6 Receipt, Storage, Transfer, and Shipment of Waste

1.2.6.1 Activity Description

Radioactive materials are routinely received, transferred, stored and shipped in the Building 991 Complex. The complex receives and stores low-level and TRU (includes residues that are to be disposed of as waste) waste in support of various projects to stabilize residue materials and to decontaminate, dismantle or demolish various facilities or portions of facilities that are planned for evacuation or the installation of new equipment or treatment processes. Relocation of radioactive waste containers from existing facilities to the Building 991 Complex will support ongoing projects and maximize the existing use of limited storage space. The complex will also be used as a storage area for radioactive waste that has been verified to meet WIPP requirements for eventual shipment to WIPP. Container types authorized for Building 991 include Type A or on-site transportation approved 55-gallon drums, Pipe Overpack Containers (POCs), Transuranic Package Transporter (TRUPACT) II Standard Waste Boxes (SWBs), metal waste crates, and wooden LLW crates. Included within this activity are:

- Receipt of sealed, metal TRU and low-level waste onsite shipping containers at east and west dock areas.
- Storage of sealed, metal TRU and low-level waste containers in Building 991 or connecting facilities.
- Transfer of sealed, metal TRU and low-level waste containers within Building 991 and connecting facilities.
- Transfer of sealed, metal LLW containers from Building 984, Building 985, and Building 991 roof to Building 991.
- Shipment of sealed, metal TRU and low-level waste onsite shipping containers.
- Receipt of wooden LLW crates at Building 991 east and west dock areas.
- Storage of wooden LLW crates under Building 991 canopy area.
- Shipment of wooden LLW crates from Building 991 Complex.
- Transfer of wooden LLW crates from Building 984, Building 985, and Building 991 roof to Building 991 canopy area.
- Satellite storage of TSCA and RCRA waste in Building 991.
- Shipment of TSCA and RCRA waste from Building 991.

Figures 1-1 and 1-2 provide simplified flow diagrams for the receipt and shipment of radioactive waste containers within the Building 991 Complex. Receipt and shipment of radioactive waste may occur from either the east or west dock or from the canopy area. The west dock area can physically accommodate two transport trucks. Normally, only one transport truck will be located at the west dock at any one time during receipt or shipment. The maximum number of radioactive waste containers that could be located at the west dock, either on the transport truck or on the dock area, is sixty 55-gallon drums, twenty TRUPACT II SWBs or twenty metal waste crates. The east dock will only be used for receipt of radioactive waste that is going to be stored in Room 166 or shipment of radioactive waste stored in Room 166. Only one transport truck can physically park at the east dock, therefore, there could only be thirty 55-gallon drums, ten TRUPACT II SWBs or ten metal waste crates on the east dock at any one time.

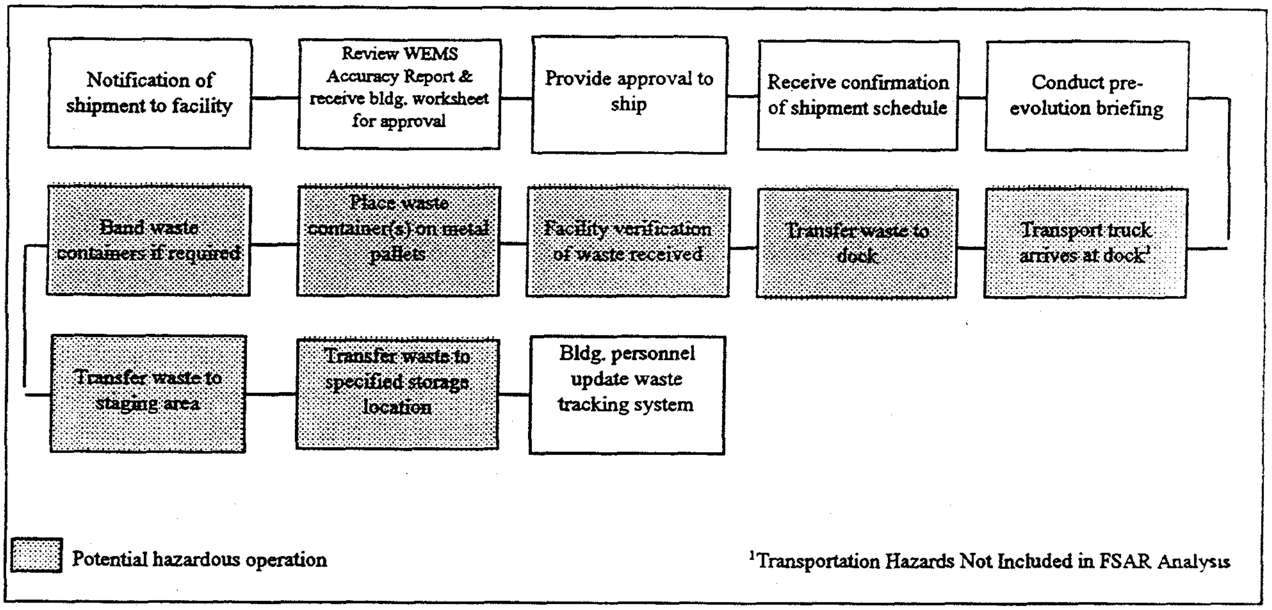

Figure 1-1 Building 991 Receipt of Waste Flow Diagram

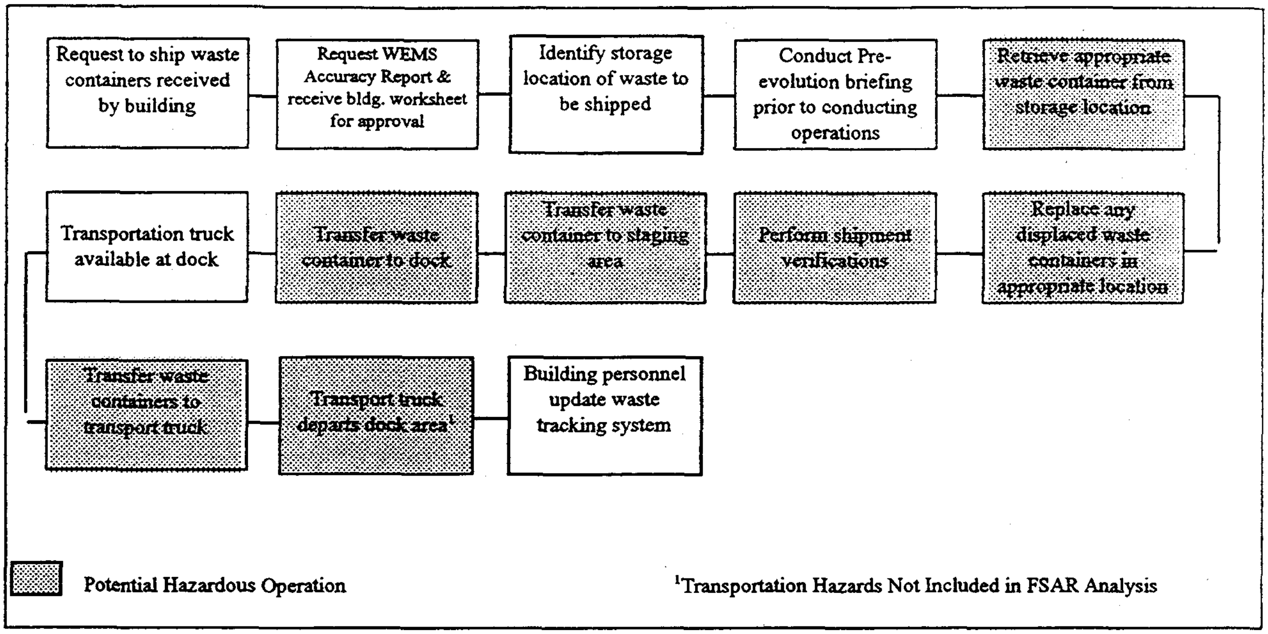

Figure 1-2 Building 991 Shipment of Waste Flow Diagram

Facility personnel are notified prior to the proposed receipt date of the pending shipment. Upon notification of a pending shipment, the Waste and Environmental Management System (WEMS) report is generated by the shipper to identify the material that is going to be shipped to and received by the building. Facility personnel then receive the building worksheet from the shipper, determine if the material meets the AB requirements of the facility (e.g., Item Description Code (IDC) restrictions, equivalent plutonium gram loading, etc.), and provide approval to the shipper to ship the material. After providing approval to the shipping facility to deliver the material the facility receives confirmation of shipment schedule. Prior to the receipt date a pre-evolution briefing is conducted with all affected personnel. The pre-evolution briefing is used to review all the tasks necessary to perform the activity with the individuals performing the task, and to discuss applicable procedures, individual assignments, public health and safety concerns, nuclear safety requirements, and any other items that could affect the conduct of the operation. Facility personnel will also ensure that appropriate individuals possess the required certifications and training, that the necessary equipment to perform the activity is available and operable, that the dock and staging areas are prepared to receive the material, and that the appropriate documentation has been prepared. Personnel transporting the radioactive waste are certified DOT Hazardous Material (HAZMAT) employees and there are transportation procedures in place that dictate transportation requirements that must be adhered to for transporting waste on-site. Hazards associated with transporting the radioactive waste from the shipping facility to the receiving facility are not evaluated in this FSAR. Building 991 personnel remove the radioactive waste containers from the transport truck once it arrives. The radioactive waste containers are manually rolled from the transport truck to the dock area (either Room 170 or the east dock). To ensure the proper waste is received, facility personnel verify the Nuclear Material Drum Transfer Report (NMDTR) against a list of expected waste containers. Waste container numbers, IDCs, and plutonium gram loading are verified. In addition, container integrity is verified upon receipt (e.g., corrosion, leaks, etc.) and facility personnel ensure the waste container is vented. After verification of the waste containers, the containers are placed on a pallet and banded (banding is required for those waste containers that will be stacked above the second tier). The palletized and banded waste containers are then moved to the staging area inside Building 991 via electric forklift truck. The waste containers are then transferred to their identified storage location within the Building 991 Complex by electric forklift trucks. This may involve stacking the waste containers up to four tiers high. Facility personnel update the Building 991 Complex waste tracking system once the waste is placed inside the facility at the designated location.

Shipment of radioactive waste from the Building 991 Complex is basically the reverse of the receipt process. Building personnel are requested to ship waste containers from the complex to a specified recipient. Prior to conducting shipment operations a pre-evolution briefing is held with affected personnel. Electric forklift trucks and hand carts may be used to move waste containers to the staging area for eventual shipment. Movement of radioactive waste containers, other than those required for shipment, may be necessary depending on the storage location of the containers scheduled for shipment. Facility personnel label and mark the container, verify the container is vented, and transfer the container to the staging area in preparation for eventual shipment. When the shipment is scheduled to take place, the waste containers are then transferred from the staging area to the dock. The facility once again verifies the waste container is ready for shipment prior to transferring the container to the dock. The waste containers are manually rolled onto the transport truck and then transported to the receiving facility. The Building 991 waste tracking system is updated by facility personnel after the waste containers are shipped.

Storage of radioactive waste can occur throughout various rooms in Building 991 and in adjoining areas. Table 1-3 details the Building 991 Complex waste storage areas by room number, square footage of room, physical stacking array in the room and the estimated storage capacity for 55-gallon drums in the storage location. The drum storage capacity for the rooms is an estimate only, the actual number of drums that may be stored in the room could be different depending on the storage configuration used and the types of waste containers stored in the room (e.g., TRUPACT II SWBs versus 55-gallon drums). Wooden LLW crates are not permitted to be stored inside Building 991 or in adjoining areas due to the combustible loading concern. Wooden LLW crates may only be stored outside Building 991 under the canopy. Site controls on outside storage of wooden waste crates do not apply to this activity since the canopy provides weather protection and is equipped with sprinklers. Wooden LLW crates may be inside Building 984, Building 985 and inside the Building 991 filter plenum to support operations and will be transferred to the Building 991 canopy area or other authorized location once the operations are complete.

Radioactive waste containers will only be stored in Building 991. Opening/repackaging of radioactive waste containers is not an authorized activity for the facility.

1.2.6.2 Safety Analysis Summary

Potential hazards associated with the receipt, storage, transfer and shipment of waste containers are radioactive materials (TRU (including residues that are to be disposed of as TRU waste) and low-level waste drums and metal crates, wooden LLW crates); kinetic energy (e.g., electric forklift trucks, transport vehicles); potential energy (e.g., stacked containers, cranes); material handling (e.g., dock, container movement); and other hazards (e.g., hydrogen explosion, degraded tunnel). Various controls are in place to prevent or mitigate the potential hazards. Trained and certified operators are used during radioactive waste container transfer operations. These personnel are familiar with the procedures used for receiving, transferring and shipping waste containers. Radiation Operations personnel are used to provide exposure rate surveys prior to and after operations involving the movement of radioactive waste containers. In addition, trained personnel are familiar with contingency procedures in case there is an incident involving a waste container.

Table 1-3 Building 991 Complex Waste Storage Locations

Waste Storage Locations	Square Footage	Stacking Array	Est. Drum Capacity[1]
Bldg. 991, Room 134	1,925	Quadruple	850
Bldg. 991, Room 135	200	Single	24
Bldg. 991, Rooms 140/141	2,604	Triple	600
Bldg. 991, Room 142	448	Double	80
Bldg. 991, Room 143	500	Triple	300
Bldg. 991, Room 147	496	Single	60
Bldg. 991, Room 148	200	Single	20
Bldg. 991, Room 151	936	Triple	400
Bldg. 991, Room 155	648	Single	120
Bldg. 991, Room 158	300	Single	56
Bldg. 991, Room 166	1,184	Quadruple	650
Bldg. 991, Room 170	3,000	Quadruple	768
Bldg. 991, Hallway north of Rooms 140/141	1,000	Double	104
Estimated Drum Storage Capacity for Building 991	**13,441**	N/A	**4,032**
Building 998 (Tunnel 998/Room 300)	1,725	Double	600
Building 996 (Vault 996)	856	Double	160
Estimated Drum Storage Capacity for Tunnels/Vaults	**2,581**	N/A	**760**
Bldg. 991 Canopy Area[2]	N/A	Double	50 LLW Crates
Total Est. Drum Storage Capacity for B991 Complex[3]	**16,022**	**N/A**	**4,792**

[1]Actual capacity of waste storage location may vary depending on storage configuration and other types of waste containers stored in the area.
[2]Only LLW crates (wooden or metal) may be stored in the canopy area.
[3]Excludes Building 991 LLW stored in the canopy area.

Conduct of receipt, storage, transfer and shipment of radioactive waste may introduce hazards and accident initiators (e.g., fires, spills) that would involve the release of MAR. These activities are evaluated in the hazard and accident analyses as to their involvement with hazardous materials and potential accident scenarios. Transferring of materials involves the

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physical aspects of material movement. Transfers in the Building 991 Complex will occur via electric forklift trucks or manually moving the waste containers. Material movement takes into account the hazards of transfer, transport procedures and equipment, and personnel training. Transfer operations involve radioactive, kinetic energy, potential energy, and material handling hazards. The waste containers for the TRU and low-level waste being transferred meet on-site transportation requirements and are qualified to at least a 4-foot drop (Ref. 9). Waste containers will be lifted above the four-foot level for placement in or removal from storage locations in Rooms 134, 140/141, 143, 151, 166, and 170. Dropping a waste container or puncturing a drum by a forklift truck illustrates a kinetic energy and material handling hazard that could initiate a radioactive spill. A potential energy source is due to the stacking of waste containers above the four-foot level. Those waste containers stacked higher than four feet could be damaged and breached in a fall resulting in a release of radioactive material.

POCs are tested to criteria more stringent than waste containers meeting Type A or on-site transportation requirements. The robustness of the POC was assessed, based on data taken from reports of Type B protocol testing conducted at the Sandia National Laboratories (crush, drop, and fire tests), pressure tests, and Finite Element computer modeling of crushing and puncturing. The POC does not qualify as a Type B container because it was not subjected to the complete Type B protocol testing program and because the pipe component is vented; however, the tests that were performed were passed and it is expected that the penetration test would also have been passed, based on computer modeling and comparison with similar containers that are certified as Type B. Accidents involving POCs do need to be considered in safety analyses, however (Ref. 10).

1.2.7 Routine Activities

1.2.7.1 Activity Description

Routine activities encompass those activities generally necessary to support day-to-day conduct of facility activities (e.g., records management, document control, security and access control). Included among the routine activities is the maintenance, calibration, testing, and repair of various non-contaminated electronic systems. The ARCIE, located in Building 991, services fire alarms, security alarms, communications equipment, maintenance control systems, and radiation instrumentation. The support includes assisting technicians in troubleshooting and repair, interfacing with other support groups at the Site, and developing and tracking maintenance programs and special projects.

Another routine activity conducted in the Building 991 Complex is evaluation of various non-contaminated metal specimens in the Metallography Laboratory. The Metallography Laboratory is seldom used any more. When used, the metal specimens are received from various locations at the Site and from off-site vendors. The samples are then analyzed for hardness, weld penetration, and grain structure and the results used for quality assurance. Equipment used in the analysis process includes two chemical hoods, a cutoff saw, grinding and polishing equipment. The Metallography Laboratory consists of Rooms 109, 110, and 110A and B.

NDT of various non-contaminated equipment or materials is routinely performed in Building 991, Rooms 160 through 165. Room 160 has an automatic film processor, and there is a dark room for processing the film, and a film interpretation room. Room 165 is used to house supplies for dye penetrant, ultrasonics, and field radiography equipment utilized by the tank/field NDT group. Radiography is used to non-intrusively inspect materials to meet customer requirements. The materials inspected by the NDT group in Building 991 are all non-radioactive. The radiography operation in Room 164 utilizes two separate methods. A portable x-ray generating device is set up in the room. A portable gamma Iridium-192 source can be used in the room to radiograph, or can be used throughout the Site to perform radiographic operations. All film generated by either radiography operation is developed in Building 991, using an automated, closed system. Ultrasonics utilize sound waves to determine things such as material integrity, material thickness, and liquid presence in piping. This testing technique is portable and can be accomplished throughout locations on Site. The ultrasonic transducer is coupled to the surface of the test piece by a glycerin gel, and interpreted on a computer terminal or readout. The dye penetrant operation inspects the surface condition of a material for surface defects. The test sequence involves cleaning the test part, applying dye penetrant, removing the excess penetrant, and applying a developer to aid in interpretation. All chemicals used in the dye penetrant operation are non-hazardous.

Significant among routine activities is the general housekeeping required for control of combustibles, hazardous materials, and radiological materials. Many of these controls are implemented through a rigorous survey and posting program by the Radiation Protection, Criticality Safety, Hazardous Material Protection, Health and Safety, Fire Protection, and Nuclear Safety Programs.

The operation of facility utilities also falls under routine activities. Utilities may support safety systems that maintain the safety envelope or habitability. Utilities include the hot water boiler system; building drain systems; water systems; ventilation systems; electric power; sanitary waste; compressed air; and domestic water. Some systems performing utility functions may involve hazardous materials. A review of hazards is performed prior to system maintenance or modification. The scope of these reviews may involve other health and safety analysis.

Routine activities also include maintaining functional emergency response capability. This activity embodies preserving the effectiveness of the emergency response plan and procedures, ensuring the presence of a trained and qualified emergency response organization, and maintaining emergency facilities and equipment in an operable and ready state. This is predominately accomplished through the conduct of periodic training drills and evaluated exercises. The drills and exercises entail implementation of pre-approved emergency response actions; demonstration of incident command and control; conduct of personnel evacuation and accountability; simulation of fire and medical emergency responses; mitigation of simulated hazardous material releases; exhibition of safeguards and security practices; and demonstration of effective communications and notifications.

1.2.7.2 Safety Analysis Summary

Potential hazards associated with the conduct of routine activities could include high voltage (e.g., work around 13.8 kV transformers); direct radiation sources (e.g., sealed sources, x-ray); thermal energy (e.g., hot water boilers, heaters, diesel generator); pressure sources (e.g., compressed air); kinetic energy (e.g., vehicles); potential energy (e.g., drum crusher, cranes); toxic, hazardous, or noxious materials; material handling (e.g., dock, various container movements); and other hazards (e.g., battery charging station, degraded tunnel). Routine activities frequently may be performed near hazardous materials and may introduce hazards and accident initiators (e.g., fires, spills) that would involve the release of MAR. These activities are evaluated in the hazard and accident analyses as to their involvement with hazardous materials and potential accident scenarios.

1.2.8 Surveillance

1.2.8.1 Activity Description

This activity predominately consists of system and equipment surveillances specified for LCO systems and other components; surveillance of other SSCs as specified in ACs; routine facility operator rounds, including maintenance of logs and records; security force tours, response actions, and accountability of Category I/II SNM; and programmatic inspections and audits (e.g., environmental compliance assessments, fire protection and radiological protection surveys, and audits from federal, state and local authorities).

1.2.8.2 Safety Analysis Summary

Various potential hazards are associated with the surveillance activity. Potential hazards include high voltage (13.8 kV transformer); radioactive materials (e.g., TRU waste, LLW, SNM); thermal energy (e.g., hot water boilers, diesel generator); pressure sources (e.g., compressed air); toxic, hazardous, or noxious materials; material handling (e.g., potential waste container movement); and other hazards (e.g., degraded tunnel).

1.3 AUTHORIZATION BASIS HISTORY

Until the approval of this FSAR for the Building 991 Complex, the AB for Building 991 consists of an approved set of Operational Safety Requirements (OSRs) (Ref. 11), USQD-991-96.0451-QRD (Ref. 12), Justification for Continued Operations (JCO) JCO-991-97.1399-MRA (Ref. 13), the JCO-991-97.1399-MRA DOE/Rocky Flats Field Office (RFFO) approval letter with additional technical direction (Ref. 14), USQD-991-98.0413-MRA (Ref. 15), USQD-RFP-97.0294-KGH (Ref. 16), USQD-RFP-97.0510-TLF (Ref. 17), DOE letter AME:ABD:SJO:02963 (Ref. 18), JCO-RFP-98.0288-KGH (Ref. 19), and USQD-991-98.0900-MRA (Ref. 20). The activities in the Building 991 Complex authorized under this set of documents include handling of Category I/II SNM in approved shipping containers (Type B), and handling and storage of TRU and low-level waste in approved containers (Type A, and those meeting on-site transportation requirements). Under this set of AB documents the Building 991 Complex inventory is controlled to a limited number of IDCs not to exceed 37.5 kilograms (kg) of weapons-grade plutonium equivalent.

The OSRs were developed based on the draft SAR last revised in 1982. The draft SAR was never approved, but the control set, in the form of OSRs, was approved in 1988 and has been maintained. The mission that the OSRs were developed to control was described as primarily receiving, storage, handling, and shipment of radioactive materials in "Department of Transportation (DOT)-, Department of Energy (DOE)-, or Site intraplant-approved shipping containers." At the time the draft SAR was written, radioactive materials transported to and from the Site were primarily SNM; TRU waste was not stored in the Building 991 Complex. A long-term Termination Shift Order (Ref. 21) was issued to address the operating parameters within the Building 991 Complex. The order prohibited any operation involving the opening of a shipping container or repackaging of fissile material containers. This Termination Shift Order has since been canceled and replaced by JCO 991-97.1399-MRA (Ref. 13).

In January, 1995, the Nuclear Safety organization was asked to evaluate the storage of TRU waste on a temporary basis in the Building 991 Complex. This evaluation (Ref. 22) assessed the safety significance of the proposed storage of twelve TRU waste types identified by IDC, in various areas (including vaults and tunnels) of the complex. In April of 1996, Nuclear Safety was requested to evaluate additional TRU waste types for interim storage in the Building 991 Complex. Analyses were performed (Ref. 12) to assess the risk associated with this activity in addition to the risk associated with that of the previously evaluated TRU waste storage activity. This second and most recent evaluation found that an USQ existed for the proposed storage of TRU waste because it created the possibility of an accident of a different type than any previously evaluated. Four scenarios and one safety concern were identified as necessary to bound the consequences from likely to extremely unlikely events in Building 991 resulting from TRU waste storage. The accident analyses performed for the temporary storage of TRU waste in the Building 991 Complex considered four accident scenarios. These accident scenarios were (1) radiological spill due to drum handling incident or tunnel collapse, (2) small fire, (3) earthquake, and (4) plane crash. The postulated accidents assumed no credit for the operability of the secondary confinement, including the HEPA filtration system, and backup power systems to mitigate consequences to the public, the worker, or to the environment. The safety concern involved a potential propane explosion due to a propane leak from the 750 Pad propane tanks located uphill from the Building 991 ventilation intake. An analysis was conducted of the dispersion of a large source of propane vapor traveling from the 750 Pad tank farm toward Building 991. The analysis predicted that the postulated propane release will not remain flammable beyond 70 feet from the release point but, for conservatism and to account for model uncertainties, a distance of 150 feet should be used. The Building 991 Complex is over 400 feet away from the 750 Pad tank farm, therefore it was concluded that it is a *beyond extremely unlikely* event that the complex could be impacted by a release from the tank farm (Ref. 23). In addition, this activity reduced the margin of safety of the facility due to the change in mission from production storage or short term shipping/receiving and storage of various low-level waste types, to the interim storage of TRU waste. No compensatory measures were identified in the USQD evaluation. The USQD did limit the IDCs that Building 991 was authorized to accept. Building 991 implemented this control via an operations procedure, OPS-PRO.003 (Ref. 24). The evaluation and supporting analyses were approved and an associated increase in risk was accepted by the DOE/RFFO in October, 1996. In this FSAR, the restriction on IDCs for the building includes those that are referenced in the Criticality Safety Evaluation (Ref. 25) and are included in Appendix A, *Building 991 Complex Technical Safety Requirements*.

In October 1997, JCO-991-97.1399-MRA (Ref. 13) was initiated to authorize Building 991 to conduct TRU waste container movement and Category I/II SNM staging while six OSR out-of-tolerance conditions existed. Two of the out-of-tolerance conditions affected the Building 991 HVAC, one affected the diesel generator, one affected the exhaust plenum in Building 985 (see discussion on the filter bypass leakage condition USQD), one affected the Building 985 fire suppression system, and the final one concerned fire doors that did not completely close therefore the fire barrier could not be maintained. Compensatory and long-term actions were identified for the out-of-tolerance conditions. DOE/RFFO approved the JCO with additional technical direction (Ref. 14). The additional technical direction identified three issues that needed to be addressed. The first issue was direction to begin transferring waste from Vaults 997 and 999 since the structural condition of Corridor C was determined by DOE/RFFO to be unacceptable without substantial remedial actions. Waste stored in these areas (Vaults 997 and 999) has since been removed. The second issue discussed the need for a DOE approved Exemption required due to National Fire Protection Association (NFPA) code violations as identified in the Building 991 Complex Fire Hazards Analysis (FHA) (Ref. 26). DOE/RFFO indicated that this issued needed to be resolved prior to utilizing Building 998 (Room 300 and Corridor A) for storage. This issue is being addressed by facility personnel. Storage in Building 998 (Room 300 and Corridor A) is evaluated in the FSAR. The third issue discussed the unacceptability of the potential for a fire in the office areas impacting waste storage areas. This issue is being addressed by installing fire doors between the office area and the storage areas.

USQD-991-98.0413-MRA (Ref. 15) evaluated the installation of natural gas fueled weatherproof boilers outside of Building 991. The evaluation concluded that an USQ existed since an accident of a different type than previously analyzed was created. This accident involved an external natural gas explosion. An evaluation of the potential explosion hazard was performed which determined that an explosion hazard did exist but that the probability of such an explosion was *beyond extremely unlikely*. The USQD also indicated that a new hazardous material was being introduced that was not previously analyzed (i.e., the natural gas). The natural gas fueled weatherproof boilers and the natural gas potential hazards are discussed in this FSAR. The USQD was approved by DOE/RFFO based on CALC-RFP-98.0555-RGC (Ref. 23) with additional direction (Ref. 27). The additional direction included (1) ensuring that the supporting accident analysis provided for the natural gas explosion is reconciled with the Site SAR methodology and that the results are incorporated into this FSAR; (2) that Kaiser-Hill ensure the boiler design package included protection of the boilers and the natural gas lines to the boilers; (3) that Kaiser-Hill ensure that the Health and Safety Practice (HSP) requirements specified in HSP 11.03 were met by the design of the boilers and that compliance is maintained during operation of the system; and (4) that Building 991 ensure that the emergency response program includes preparation for response to a natural gas leak/rupture. This FSAR incorporates the results of Ref. 23 into the evaluation of the hazards imposed by the natural gas boilers.

USQD-RFP-97.0294-KGH (Ref. 16) involves a condition of HEPA filter bypass at three facilities on the Site, including Building 985. This item was addressed in JCO-991-97.1399-MRA (Ref. 13). Fan shaft seals in fans 601A and 601B were found to have bypass leakage of 31 cubic feet per minute (cfm). Because of this discovery, no waste is allowed inside Building 985. For Building 985, there is no MAR inventory currently available to become involved in an event that could result in an unfiltered release. A control due to this condition was proposed in the USQD. This control requires that any waste generated as a result of maintenance work or filter changes must be removed from the building to an approved waste storage area within 24 hours of job completion. These controls were implemented by Operations Order 00-991-04 (Ref. 28). Neither the MAR control or the annual surveillance control were implemented in this FSAR since the level of contamination found in the filters in the past has been negligible, storage of waste containers is not authorized for Building 985, and the Building 985 filter plenum is not a credited safety SSC based upon the safety analysis presented in NSTR-011-98 (Ref. 3).

USQD-RFP-97.0510-TLF (Ref. 17) was initiated due to a discovered condition of americium quantities present in quantities greater than analyzed in existing AB documents. Consideration of the americium results in an increase in the consequence of accidents previously analyzed for Building 991 and an increase in malfunction of equipment important to safety previously analyzed in safety analyses which made this a positive USQ. Technical direction provided by DOE/RFFO (Ref. 29) required that any high americium drums be removed from the building and that the Building 991 OSR be revised to include the equivalent weapons grade (WG) plutonium MAR control for high americium. All high americium drums, with the exception of one (208 grams WG Pu equivalent), have been removed from the facility. An exception for this one drum has been incorporated into Appendix A, *Building 991 Complex Technical Safety Requirements*, AC 5.2, that allows this drum to remain in the building until it can be shipped to another facility for repacking. This drum presents no adverse impact on the safety analysis assumptions. AC 5.2 ensures that other high americium drum, unless in Pipe Overpack Containers (POCs), are restricted from the complex. The Building 991 OSRs were not revised since this FSAR was in development and included a control to calculate the weapons grade (WG) plutonium (Pu) equivalency based upon a factor of 66 for each gram of americium. This control was added to Operations Procedure OPS-PRO-003 (Ref. 24) prior to final approval of the FSAR.

DOE letter AME:ABD:SJO:02963 was issued to provide additional DOE technical direction on HEPA filter degradation due to wetting during system testing. Four of the eight items applied to Rocky Mountain Remediation Services (RMRS) facilities. These were technical direction items 3, 4, 6, and 8. Item 3 indicated that facilities could update their OSRs/TSRs to DOP-test a stage other than that wetted by the manual deluge system. Item 4 indicated that ventilation system and fire fighting strategies, and/or its Implementation Plan,

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should be revised to address emergency response drills on fires. Item 6 provided approval to discontinue the current 6 month and 12 month full-flow surveillance of the automatic and manual deluge systems to prevent further degradation of the HEPA filters. Item 8 indicated that the issue of degraded HEPA filters should be evaluated in the updated Building 991 draft Final Safety Analysis Report. These items have been addressed by RMRS and by this update to the Building 991 Complex FSAR. Full-flow deluge system testing for the Building 991 Complex filter deluge systems was discontinued on April 30, 1998 in accordance with memorandum FPH-058-98. This addressed Item 6. Items 3, 4, and 8 were addressed by memorandum FPH-069-98. For Item 8 specifically, this FSAR does not credit the Building 991 or Building 985 exhaust filtration systems specifically in the accident analysis, but does indicate that the Building 991 system is a defense-in-depth system and should be maintained in accordance with the requirements specified in the TSRs (AC 5.5). The Building 985 exhaust filtration system is not considered a defense-in-depth system. The automatic sprinkler system is credited in the accident analysis (LCO 3.1) but the plenum deluge system is specifically excluded from the portion of the automatic sprinkler system being credited (Reference Chapter 5).

USQD-RFP-97.0106-CAS (Ref. 30) evaluated a non-compliance discovery issue and JCO concerning Site pressure relief devices and the overall Pressure Safety Program. The Site, over the past ten years has not met the requirements of HSP 11.03. HSP 11.03 references Rocky Flats Environmental Technology Site (RFETS) Standard SM-137 which establishes the replacement frequency for pressure relief devices (PRDs) and other maintenance requirements. JCO-RFP-98.0288-KGH (Ref. 19) was initiated to provide temporary authorization to conduct continued operations at the Site while an acknowledged USQ condition exists. The JCO serves as part of the facility AB until compliance is restored, or until authorized otherwise by Kaiser-Hill. The USQD evaluation resulted in a positive USQ but indicated that the various failure mechanisms and the resultant release mechanisms associated with PRD failures are not significant in terms of overall public risk. The USQD concluded that spills, explosions, fires, and compromises to vital safety system operability considered in the existing ABs for the various facilities are either of substantially higher probability or consequences than those represented by potential failure of pressure relief devices or pressure vessels to the extent that the overall public risk from such failures can be considered to be within present facility safety envelopes. The primary concern from pressure safety feature malfunction is the impact on worker safety. Required actions are specified in the JCO that will remove the hazard where possible, and also serve to heighten personnel awareness of the issue. This JCO was approved by DOE on May 20, 1998 with additional technical direction. The approval allowed continued Site operations with an acknowledged USQ issue. Compensatory measures included (a) annual inclusion of Pressure Safety in Monthly Safety Meeting Kit Topics, (b) identification of any currently pressurized systems that are candidates for depressurization and rendering them so, and (c) expansion of the Job Hazard Analysis (JHA) process as it is used in the IWCP. The use of pressure relief devices and the stored energy in pressure systems is evaluated in this FSAR in NSTR-011-98 (Ref. 3) and identified no concerns that would result in a release of radioactive materials.

USQD-991-98.0900-MRA (Ref. 20) was issued on May 21, 1998 as a negative USQD. Revision 0 of this USQD approved storage of POCs for IDC 370 and for 51 drums of IDC 454X based on a maximum container inventory of 200 grams Pu equivalent and criticality controls as documented in Revisions 1 and 2 of Criticality Safety Evaluation (CSE) BSM-583. Revision 1 of this USQD was issued to approve storage of POCs for IDCs 312, 368, 411X, 429X, 433X, and 454X based on Revision 3 of CSE BSM-583.

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1.4 REFERENCES

1 *Safety Management Programs*, Rocky Flats Environmental Technology Site Safety Analysis Report (Site SAR), Volume I, Chapter 6, Nuclear Engineering, Kaiser-Hill Company, Golden, CO, April 1997.

2 *Preparation Guide for U. S. Department of Energy Non-reactor Nuclear Facility Safety Analysis Reports*, **DOE-STD-3009-94**, U. S. Department of Energy, Washington, D. C., July, 1994.

3 *Safety Analysis for Building 991 Complex Final Safety Analysis Report*, **NSTR-011-98**, Nuclear Safety Technical Report, Revision 1, Rocky Mountain Remediation Services, L.L.C., January, 1999.

4 Work Authorization Document (WAD) #37, 991 Cluster Project, R. Lahoud, October 7, 1996.

5 *Designation, Reportable Quantities, and Notification*, **40 CFR 302**, Code of Federal Regulations, Office of the Federal Register, Washington, D. C.

6 *Emergency Planning and Notification*, **40 CFR 355**, Code of Federal Regulations, Office of the Federal Register, Washington, D. C.

7 *Process Safety Management*, **29 CFR 1910.119**, Code of Federal Regulations, Office of the Federal Register, Washington, D. C.

8 *Risk Management Programs (RMP) for Chemical Accidental Release Prevention*, **40 CFR 68**, Code of Federal Regulations, Office of the Federal Register, Washington, D. C.

9 *On-site Transportation of Hazardous and Radioactive Materials Manual*, **1-93-Traffic-110**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, Effective Date November 15, 1995.

10 *Evaluation of Pipe Overpack Containers for TRU Waste Storage*, **NSTR-001-97**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, April 10, 1998.

11 *Building 991 Operational Safety Requirements*, Rocky Flats Environmental Technology Site, Golden, CO, October, 1997.

12 *Addition of Transuranic Waste to Building 991 for Storage*, **USQD-991-96.0451-QRD**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, January 27, 1997.

13 *Justification for Continued Operation (JCO) Building 991 HVAC, Emergency Generator, and Fire Suppression Out of Tolerance*, **JCO-991-97.1399-MRA**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, March 31, 1998.

14 *Building 991 Justification for Continued Operation with HVAC, Emergency Generator, and Fire Suppression Out of Tolerance - JCO-991-97.1399-MRA*, Approval letter from Klein to Parker, Letter No. **AME:ABD:RGB:04936**, December 16, 1997.

15 *IWCP T0095441 Building 991 Installation of Weatherproof Boilers*, **USQD-991-98.0413-MRA**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, February 26, 1998.

16 *RFETS HEPA Filter Bypass Leakage Discovery Conditions*, **USQD-RFP-97.0294-KGH**, Rocky Flats Environmental Technology Site, Golden, CO, April 15, 1997.

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17 *Americium in Quantities Greater Than Analyzed in the FSARs*, **USQD-RFP-97.0510-TLF**, Rocky Flats Environmental Technology Site, Golden, CO, May 29, 1997.

18 *Rocky Flats Field Office Disposition of High Efficiency Particulate Air Filter Unreviewed Safety Questions/Issues*, **AME:ABD:SJO:02963**, DOE letter providing additional technical direction, April 24, 1998.

19 *Justification for Continued Operation (JCO) Addressing RFETS Non-Compliance with Pressure Safety Program Requirements*, **JCO-RFP-98.0288-KGH**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, February 9, 1998.

20 *Storage of Pipe Overpack Containers in Building 991*, **USQD-991-98.0900-MRA**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, May 27, 1998.

21 *Termination Shift Order*, **991-97-002**, Revision 2, Rocky Flats Environmental Technology Site, April 1997.

22 *Storage of TRU Waste in Building 991*, **USQD-991-95.0391-MDT**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, February 15, 1995.

23 *Site Fuel Gas Systems Hazards Analysis*, **CALC-RFP-98.0555-RGC**, Revision 0, Nuclear Safety Engineering Calculation, Rocky Flats Environmental Technology Site, April 30, 1998.

24 *Waste Control in Building 991 Complex*, **OPS-PRO.003**, Revision 0, November 25, 1997.

25 *Criticality Controls in Building 991*, **BSM-583**, Criticality Safety Evaluation, Revision 0, August 7, 1997.

26 *Fire Hazards Analysis Building 991 Complex*, **FHA-991-003**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, August 28, 1997.

27 *Positive Unreviewed Safety Question - Installation of Weatherproof Boilers Outside of Building 991 - USQD-991-98.0413-MRA*, **AME:ABD:RGB:02945**, Letter from K. Klein to A. Parker, April 21, 1998.

28 *Building 991 JCO Implementation*, **00-991-04**, Operations Order, Revision 2, Rocky Mountain Remediation Services, Expiration Date of August 14, 1998.

29 *Site Americium Unreviewed Safety Question*, **AME:ABD:JMC:04756**, Letter from K. Klein to G. M. Voorheis, September 22, 1997.

30 *Pressure Relief Device Inspection and Testing*, **USQD-RFP-97.0106-CAS**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, February 13, 1998.

CHAPTER 2

FACILITY AND SYSTEMS DESCRIPTION

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2. FACILITY AND SYSTEMS DESCRIPTION

2.1 INTRODUCTION

This chapter discusses the operating history of the facility and provides descriptions of the Building 991 Complex structures, systems and components (SSCs) to support assumptions used in the hazard and accident analyses and the derivation of control requirements presented in this Final Safety Analysis Report (FSAR). Credited preventive and mitigative features for portions of the Building 991 Complex are described in Appendix A, *Building 991 Complex Technical Safety Requirements.*

2.2 COMPLEX OVERVIEW

This section provides an overview of the basic Building 991 Complex buildings and structures, including construction details such as basic floor plans, equipment layout, construction materials, controlling dimensions, and dimensions significant to the hazard and accident analysis activity. All facilities considered part of the Building 991 Complex are briefly described in the following divisions of this section.

2.2.1 Operating History

The Architect-Engineer who designed the original Building 991 and the primary construction contractor was The Austin Company out of Cleveland, Ohio. Ground breaking occurred on July 10, 1951 for the first permanent buildings at the Site. Included in the initial construction was a small group of buildings identified as the 991 Complex, with the primary building being Building 991. Building operations started in April of 1952. Building 991's main function was assembly, shipping and receiving of final components produced at the Site, Hanford and Oak Ridge. Building 991 functions also included administrative support (later moved to Building 111), product inspection, research and development, and material storage and accountability.

By the early 1960's, product assembly and most research and development activities were relocated. In 1964, beryllium coating operations began in a Building 991 research laboratory. From 1966 to 1974, Building 991 was occupied by groups conducting welding, coating, ecology and product engineering operations. As part of product engineering, testing was conducted to determine the quality of non-nuclear raw materials and parts fabricated by off-site vendors. The building also inventoried and stored these parts for future use.

During the mid-1970s, research and development operations, including beryllium coating, were relocated to Building 705. Scrap beryllium storage, refurbishment of shipping containers, and procurement, receipt, shipment, and storage of forms used by production operations were added to the operations conducted at Building 991. In 1974, Building 985 was constructed to house the air handling system that supports the underground storage vaults.

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During the 1980s, Final Quality Certification, Procurement Quality Engineering, Metallography Laboratory, and Nuclear Materials Control and Accountability were added to Building 991. In 1985, a new receiving dock (Room 170) was added to Building 991 for off-site shipment of special nuclear material (SNM) via safe-secure transport (SST). In 1986, Building 984 was constructed for the storage of approved shipping containers.

Several operational changes occurred between 1988 and 1992. Finished machined product receipt, certification, storage, and shipment was relocated to Building 460. Limited operations remained in Building 991 until March 1992, when final quality certification relocated to Building 130. Raw material receipt, certification, storage, and shipment also relocated to Building 130. Procurement quality engineering relocated to Buildings 460 and 850. Machining relocated to Building 130. Administrative offices increased to include Technical Operations Control and Radiological Engineering, and the Surface Laboratory was assembled in Room 155 to test new cleaning methods to replace the carbon tetrachloride and 1,1,1-trichloroethane used in glovebox operations.

In 1992, the Alarm Radio Communication Instrumentation and Equipment (ARCIE) group moved their equipment and personnel to Building 991. Also during 1992, a decision was made to evacuate all SNM from the Building 991 Complex based on multiple evaluations that identified several potential and/or confirmed concerns. The concerns were (1) visible cracks and the potential for other structural deficiencies with concrete corridors that connect vaults, (2) water seepage into the corridors and vaults which may cause corrosion of containers, (3) questionable adequacy of fire detection and suppression systems, (4) questionable criticality detector coverage of the vaults, (5) marginal vault ventilation systems, and (6) potential danger from the propane tanks located on the hillside west of Building 991 at the 750 Pad. Therefore, containers of Category I/II SNM were relocated from Vaults 996, 997, and 999 and Corridor C of the Building 991 Complex to Building 371 as interim storage while others were consolidated in Building 991 vaults (Room 150) (Ref. 1).

In 1995, Unreviewed Safety Question Determination (USQD) USQD-991-96.0451-QRD evaluated the temporary storage of transuranic (TRU) waste in Vaults 996, 997 and 999 (Ref. 2). The concerns identified in 1992 were addressed in this USQD. Concern 1 was determined to need more extensive technical evaluation. A conservative safety analysis was performed considering a drum breach due to mishandling resulting in a spill and a spill initiated by an earthquake. These analyses were performed to provide an estimate regarding the risk of the proposed activity assuming Concern 1 was valid and that no actions were going to be taken. Concern 2 was determined to not be an issue since the containers were not intended to be permanently stored in the vaults. Concern 3 was addressed by limiting the Item Description Codes (IDCs) to those not considered highly combustible, controlling other combustible material in the area, temporary storage of waste in the vaults, and by quantifying consequences of both a small and large fire. Concern 4 was determined not to be an issue since Criticality Safety determined that infinite arrays of 200 gram or less waste drums, stacked four high, are subcritical. Since that evaluation, Criticality Safety released a Criticality Safety Evaluation (Ref. 3) that identified no credible criticality accident scenarios associated with current activities of TRU waste storage and SNM staging in Building 991. Concern 5 was addressed by showing consequences for each scenario without crediting high efficiency particulate air (HEPA) filters in case no actions are taken regarding the ventilation system. Concern 6 was determined to need more extensive technical evaluation. A conservative safety analysis was performed to provide an estimate regarding the risk of the waste storage assuming the concern was valid and no actions were taken. Since the release of this USQD, an evaluation of the risk posed by the propane tanks determined that an explosion hazard did not exist (Ref. 4). The mission for the Building 991 Complex changed to that of a TRU Waste Storage Facility in August of 1995 when TRU waste was accepted into the facilities.

Documented occurrences from 1991 to 1996 were reviewed for the Building 991 Complex. There were no occurrences involving a chemical or radiological release of material during this time frame. Equipment failure or deficiencies caused over 75% of the documented occurrences. The aging of the equipment in the Building 991 Complex was the predominant reason for the equipment failure. Aging of equipment will probably continue to be the dominant reason for equipment failure in the future. The equipment considered important to safety will be less susceptible to equipment failure due to aging due to the rigor that is applied to maintain the equipment (i.e., System Category (SC)-1/2 and SC-3 SSCs). That equipment not considered important to safety will normally receive less attention (i.e., equipment not considered SC-1/2 or SC-3 SSCs).

2.2.2 Complex Description

The Building 991 Complex is located on the east side of the developed portion of the Site within the protected area (PA) as shown in Figure 2-1 and Figure 2-2. Building 991 is the main building of the Building 991 Complex. Facilities included in the Building 991 Complex are:

- Building 991 - Waste Operations Facility.
- Corridor C - Tunnel connecting Buildings 996, 997 and 999 (storage in Corridor C is currently prohibited by Operations).
- Buildings 997 and 999 - These buildings are vaults. Previous waste storage areas (storage in Buildings 997 and 999 is currently prohibited by Operations).
- Building 996 - This building is a vault. Low-level and TRU (including residues identified as waste) waste storage area.
- Corridor B (also known as Tunnel 996) - Provides access to Building 996 and Corridor C from Building 991.
- Building 998 - Consists of Room 300 and Corridor A - Low-level and TRU (including residues identified as waste) waste storage area. Corridor A (also known as Tunnel 998) provides access to Room 300 from Building 991.
- Building 985 - Filter Plenum Building for Vaults 996, 997 and 999, Corridor C and Corridor B.

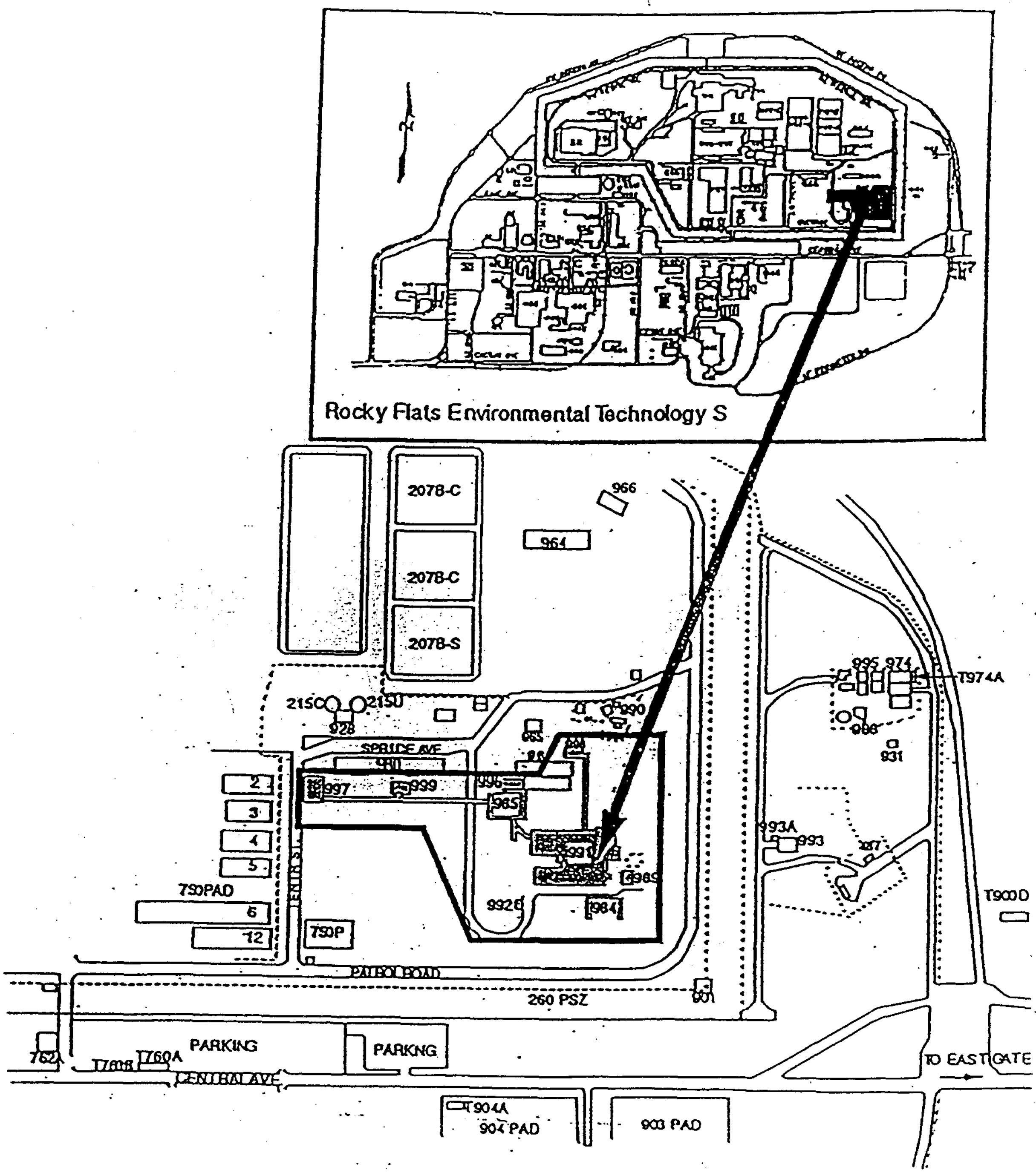

Figure 2-1 Site Location of the Building 991 Complex

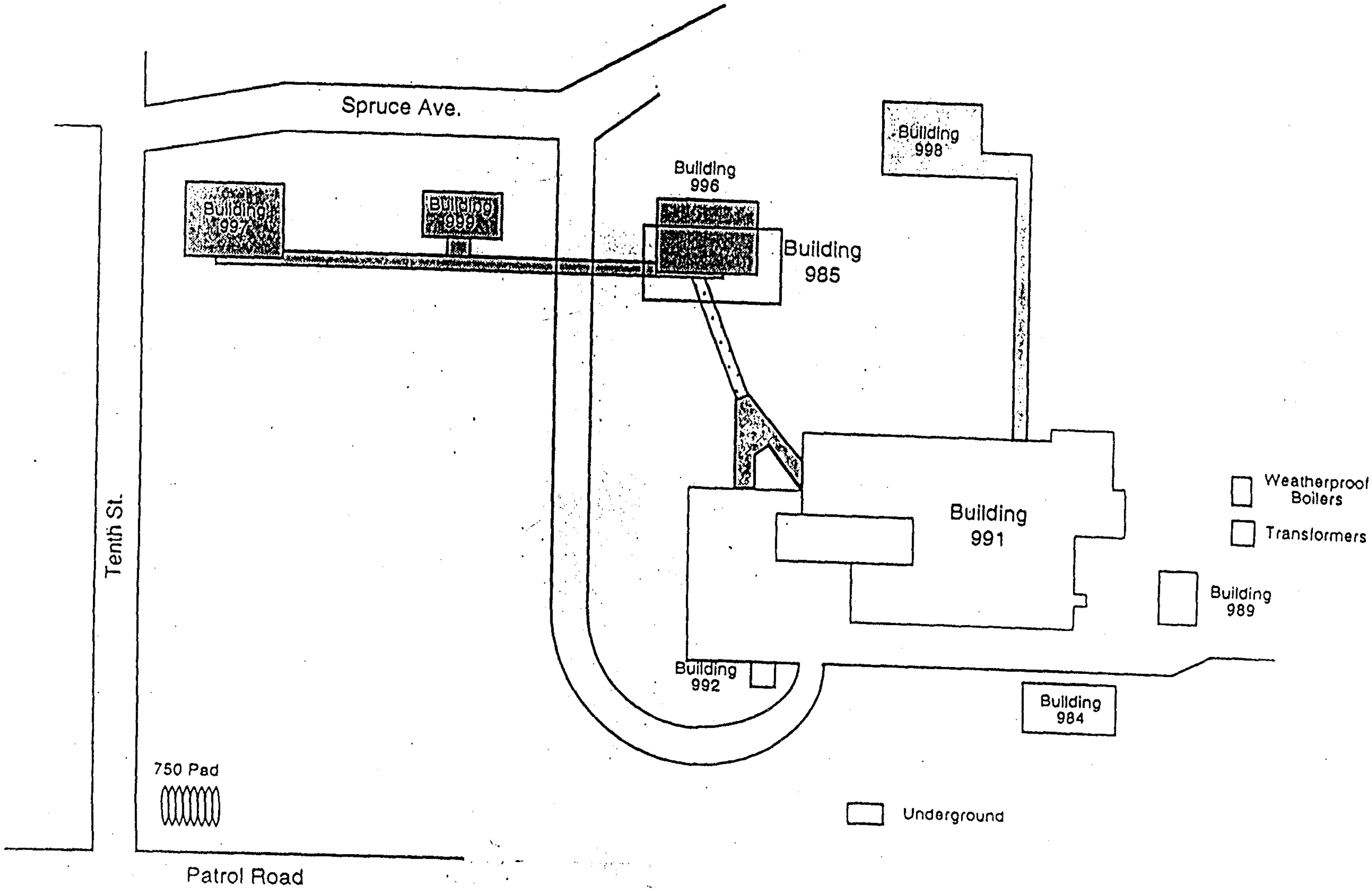

Figure 2-2 Building 991 and Associated Complex Buildings

- Building 989 - Diesel Generator Building for Building 991 Complex.
- Building 984 - Drum crushing facility
- Building 992 - Normally unoccupied Guard Post

Building 991, the main structure of the complex, is a one-story structure with a partial basement. The 36,259 square foot building is primarily reinforced concrete and metal on metal framing. Connected to Building 991 by corridors are Buildings 996, 997, 998, and 999. These buildings and the corridors leading to them, comprising 20,940 square feet, are all underground and made of reinforced concrete.

There are two support structures for Building 991, (1) Building 985, the Filter Plenum Facility, and (2) Building 989, the Diesel Generator Facility. Building 992 is a former Guard Post located southwest of the Building 991 facility that is normally unoccupied. Empty Department of Transportation (DOT)-approved shipping containers and packaging materials, and ARCIE spare parts are stored in Building 984 which is a metal shed located on the southeast side of Building 991. Building 984 also contains the drum crushing operations. Receiving and shipping dock facilities are located on the west and east sides of the building. Also on the west side of the building, in close proximity to the dock area, is an out-of-service paint booth located against the building's west wall.

2.2.3 Building 991

The design for Building 991 was completed in 1951 and followed structural military protection criteria. The original structure, which included Buildings 996, 997, and 998 plus Corridors A, B and C, was completed in 1952. A subsequent addition, Building 999, was constructed adjacent to Corridor C in 1956. Three major additions have been built since then: (1) a west side loading dock, (2) a radiography vault, Rooms 164 and 165, was added in the northeast corner, and (3) a covered loading dock and maintenance area was added on the southeast side of Building 991. The Building 991 floor plans are as shown in Figures 2-3 through 2-5.

The foundations of Building 991 are composed of footings and foundation walls. There are three basic types of footings: (1) individual spread footings, (2) combined footings, and (3) wall footings. The individual spread footings vary from 39 inches square by 15 inches thick to 48 inches square by 15 inches thick. The combined footings are of two types: (1) 3 feet wide by 15 feet long and either 2 feet or 2 feet 7 inches thick, and (2) 5 feet 2 inches wide by 19 feet long by 2 feet thick. The wall footings vary from 2 feet wide by 10 inches thick to 5 feet wide by 1 foot 6 inches thick (Ref. 5).

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Bearing walls and intermediate concrete columns are the structural framing in Building 991. All exterior concrete walls are bearing walls. They are reinforced concrete that vary from 12 inches thick to 18 inches thick on the north side of the building, which is set against a hill. The radiography vaults in the northeast corner of the building have 3 foot thick reinforced concrete walls. The maintenance shop addition has eight inch thick concrete block bearing walls. The building walls vary in height from 14 feet on the south to 27 feet in the center to 18 feet on the north side (Ref. 5). The covered dock and shop at the east end of the building have reinforced concrete grade walls, 6 feet 5 inches high by eight inches thick, which rest on footings.

The Fire Hazards Analysis (FHA) has identified one fire wall that needs to be maintained for the facility. This fire wall includes fire doors in the north-south corridor of the main floor, between Room 134 and Room 170, and between Room 140/141 and Room 170. Fire doors are installed in the north-south corridor of the main floor to separate the office area from the storage area (Room 134). These fire doors meet a 1-1/2 hour fire rating and were installed in accordance with National Fire Protection Association (NFPA) 80, *Fire Doors and Fire Windows* (Ref. 6). The other walls inside Building 991 are of substantial structure, concrete and cinder block, whereby they would act as fire barriers. The walls have not been so designated for the facility due to the low combustible loading in the building.

There are two reinforced concrete retaining walls. One runs approximately 50 feet west from the northwest corner of the building until it connects with the second retaining wall. The second retaining wall runs 172 feet south from the southwest corner of the entrance to the tunnel leading to the storage vaults. The wall varies in height from 10 feet 6 inches to 9 feet 4 inches (Ref. 5).

The utility tunnel basement is approximately H-shaped, just like the main floor corridors above it (see Figure 2-4). The north leg is 156 feet long, the south leg is about 204 feet long, and the north-south cross leg is over 78 feet long. The north leg is 11 feet 6 inches wide, the south leg is 9 feet 6 inches wide, and the north-south leg is 8 feet wide. The tunnel height is 9 feet (Ref. 5). The floor of the basement (utility tunnel) under Building 991 is 1 foot above creek elevation at the southwest corner of the building. The utility tunnel has a complete sub-drain system that flows into a 6-foot deep sump. The sump is drained by two 60-gallon per minute (gpm) sump pumps that discharge into the storm drain system (Ref. 5).

An evaluation of the floor loading capacity was requested by building personnel to ascertain the limits on the storage of radioactive waste in Building 991 potential storage areas (i.e., Rooms 134, 140/141, 143, 150, 151, 155 and the northern east-west running hallway). This evaluation was considered necessary due to a suspicion by Kaiser-Hill Security and others that there were secret rooms built in the basement. A review of the structural drawings by Rocky Mountain Remediation Services (RMRS) engineering indicates that the ground floor of the building (main floor) is a six-inch slab on grade, except that the halls are a six-inch slab that spans over the basement tunnels. An x-ray instrument was then used to investigate the possibility of rooms behind the concrete walls of the basement tunnels. The investigation determined there was air space behind the basement walls in a few areas of the basement tunnels.

The engineering investigation determined that (1) there is no real knowledge of what function the Air Force used the basement for; (2) that there is no evidence of previous openings which have been closed with concrete or other material; (3) there is no unusual pipe or conduit penetrations in the basement walls and the concrete filled around them is consistent with construction practices when earth is on one side of the wall; and (4) the air space identified by the x-ray machine could just be the normal one to two inches of air space between the basement wall and the earth that was left there to allow water to drain down the wall and out the drainage pipes next to the foundations. Based upon RMRS engineering's evaluation they determined that the floors in the storage areas can support 800 pounds/square foot (psf) and the hallway floors can support up to 300 psf. (Ref. 7, 8, and 9).

There are four different roofs on Building 991. The original building has a reinforced concrete slab supported by concrete beams. The concrete slab varies in thickness from 4 inches to 15 inches. On top of the slab is a 1 inch thick foam insulation and then built-up roofing. The roof of the radiography addition is 6 inch thick reinforced concrete with 1-½ inches of insulation and then built-up roofing. The west side loading dock building addition has structural steel roof framing with corrugated asbestos cement roofing. One structural steel column and the existing concrete walls support the roof framing. The southeast side, covered loading dock and Room 166, has open-web steel roof joists with metal decking covered with insulation and built-up roofing (Ref. 5). A review of design criteria for the Building 991 Complex storage area roofs was performed by RMRS Engineering. The roof structure for the original building was designed to withstand 35 psf (Ref. 10) and the roof over Room 170 was designed to withstand 30 psf (Ref. 11).

A structural evaluation of Building 991 was conducted in 1979 by Agbabian Associates (Ref. 12). This evaluation concluded that the construction of Building 991 was adequate for the criterion seismic loading of 0.14 g peak horizontal acceleration at bedrock. The safe allowable loads for Building 991 for tornado and wind were determined to be 115 miles per hour (mph) and 96 mph respectively. Under both the tornado and wind loads, the columns were determined to be overstressed and the 4 inch roof slab inadequate for uplift for the criteria values of 200 mph for tornado and 150 mph for wind. The 4 inch roof slab is located over the office area portion of the building and over Room 134. The northern portion of the building has a roof slab that is thicker than 4 inches. Structural modifications were suggested in the report for strengthening the building components where failure was predicted. These suggested modifications included (1) strengthening the 4 inch roof slab to provide negative bending capacity at the center of the slabs for tornado and wind uplift pressures; (2) strengthening the roof beams and girders to provide negative bending capacity at the center of the members for tornado and wind uplift forces; and (3) reinforcing building columns to provide additional capacity for bending and axial loads. These suggested modifications have not been implemented.

2.2.4 Corridor C

Corridor C tunnel extends from Building 996 to Building 997 with Building 999 located approximately at the midpoint of the tunnel. The corridor is an underground, reinforced concrete structure with exterior dimensions of eight feet wide, 10 feet high, and approximately 660 feet long. The walls, roof and floor are 15 inches thick. The earth cover varies throughout the length of the corridor and is estimated to be up to 21 feet in some locations.

Corridor C has a documented history of cracks in its concrete structure and groundwater infiltration associated with many of the cracks since the 1960s. Reference 13 discusses the types of cracks noted in Corridor C. The report indicates there are two types of cracks in Corridor C; (1) transverse cracks around the corridor cross-section, and (2) longitudinal cracks along the corridor axis. There are two different types of transverse cracks. One set of transverse cracks are present throughout the entire length of the corridor. These cracks are likely caused by the opening of construction joints caused by shrinkage of the corridor. In some instances the cracks are located where the axial stiffness of the corridor has been decreased such as at locations where unistruts are embedded in the roof to support ducts and electrical service. This type of cracking normally occurs early in the life of the structure with no expected changes considering the current age of the corridor. The widths of these transverse cracks appear to be small (< 1/8 inch) and some water seepage is evident. The cracks do not effect the capacity of the corridor since the primary load path for the soil loads is through frame action transverse to the corridor axis. These cracks would have to be considered in designing a system to resolve the water seepage problem.

The second set of transverse cracks is shear cracks in the walls of the corridor. These cracks occur at a few locations in the corridor, are inclined at angles close to 45 degrees with the vertical, are fairly wide (up to ¼ inch), and are subject to water seepage. These cracks appear to have been caused by differential settlement along the length of the corridor and between the corridor and vaults. The largest of these shear cracks are at the location where Building 999 is connected to the corridor. It is likely that settlement of the vault structure introduced loading on the corridor resulting in the cracks. These cracks do not effect the capacity of the corridor since the primary load path for the soil loads is through frame action transverse to the corridor axis. These cracks would have to be considered in designing a system to resolve the water seepage problem.

Longitudinal cracks exist in the roof and floor of the corridor and run the entire length of the corridor. There are typically three cracks near the center of the roof slab that are spaced at about seven to eight inches. These cracks are tight (< 0.02 inches) and show no signs of water seepage. These cracks are probably flexural in character and are caused by the soil overburden acting on the roof. A crack width of 0.02 inches at a spacing of seven inches could indicate tensile strains of about 0.0029 (0.02 / 7). This is about twice the yield strain of the 40 ksi yield reinforcing steel. Since the rupture strain of the reinforcement is about ten times this amount it is concluded that collapse of the corridor by extension of these cracks is not imminent. It should be noted that the ultimate strength of the reinforcement is likely to be at least 50 percent higher than the yield strength providing additional margin against collapse. The cracks in the floor are of the same character as the roof cracks. The report concluded that while the longitudinal cracks indicate the margins in the corridor are less than would be required for a safety analysis, they do not indicate that any immediate danger exists.

The report also noted no evidence of corrosion of the reinforcement. Significant corrosion is usually accompanied with spallation and rust staining of the concrete. Neither of these attributes was observable.

Several other structural assessments have been performed for Corridor C. The structural assessments confirmed inadequate reinforcing steel was installed in the structure to meet existing design standards for support of the original and current level of soil overburden. The reduced margins of safety in the design were then considered along with other pertinent factors. These factors included the documented forty years of performance, the documented stability of the identified cracks over four years of record, the (minor) nature of the flexural cracks in the region of overstress, and the ductile (slow) and observable progression of the predicted failure mechanism. Significant deformation could be accommodated before collapse would be imminent, and a monitoring system would give sufficient warning time to take remedial action if further distress of the corridor were to occur. These considerations supported a position that catastrophic failure was not imminent from a structural view, and that it was reasonable to continue operations, with compensatory actions, until a safe and orderly restoration of safe material storage conditions could be accomplished. One recommended compensatory action, installing a crack monitoring system (strain gages), was implemented to provide indication of further degradation of the corridor. Other compensatory actions such as removing the soil overburden, posting the area to prevent increases in overburden loads, sealing of actively leaking cracks by sealant injection, and re-constructive repair of major cracks have not been implemented.

Based upon the evaluations performed, and the costs associated with repairing the tunnel to meet acceptable structural criteria, storage of radioactive waste is currently prohibited in Corridor C. This prohibition is reflected in Appendix A, *Building 991 Complex Technical Safety Requirements*, Administrative Control (AC) 5.2.

2.2.5 Buildings 997 and 999

Building 997 is an underground vault structure located northwest of Building 991. The building was built to withstand exceptionally high blast pressures. The exterior walls are 14 feet 6 inch thick reinforced concrete. The roof is 12 feet thick concrete with one to 10 feet of earth covering. The floors are six feet thick concrete and the interior partitions are two feet thick concrete. The outside dimensions of the building are 60 feet by 68 feet. The building has four main storage areas, which are 12 feet wide by 18 feet 6 inches long by 10 feet high. The original design criteria of Building 997 required the structure to support specific dead loads and to withstand the blast pressure of a semi-armor piercing 2,000 pound bomb (1,000 pounds per square foot blast pressure and 18.7 inches diameter, 1,100 feet per second inert penetration). For Building 997 this criteria included a direct-hit penetration resistance (Ref. 1 and 14). Building 997 is a massive structure and a structural evaluation performed in 1979 indicated that the structural components are capable of withstanding the seismic loads from a design basis earthquake (DBE). The building, being underground, is not subject to tornado or wind loading, or impact from tornado-driven missiles (Ref. 15 and 16).

Minor cracks and leaking have been noted in Building 997, specifically in Rooms 601A and 601B. The cracks are in the lintel sections over the doors. The concrete cracking in the lintels of the interior walls of Building 997 has been attributed to shrinkage cracks resulting from the original mass concrete placement. The 12 foot thick concrete slab over each lintel was determined to be capable of readily arching all loads over these spans, eliminating structural capacity concerns due to the cracking (Ref. 17). In August 1992, a review of the Agbabian calculations as well as additional checks, indicated that Building 997 met existing conventional and natural phenomena load requirements (Ref. 18).

Building 999, built in 1956, is an underground, reinforced concrete vault structure with outside dimensions of 49 feet by 33 feet and is accessed from Corridor C through a 10 foot 6 inch long by 13 foot wide vestibule. The building is a box structure with three separate areas. The roof is 21 inches thick and is supported by 18 inch thick exterior walls and 24 inch thick interior walls. The walls are supported by continuous spread footings with a top of footing elevation of 12 inches below the floor slab. The floor slab is 6 inches thick and lightly reinforced. The floor to the bottom of roof slab height is 10 feet. The cross-section of the vestibule appears as a continuous box structure constructed of a 15 inch thick roof slab, 18 inch thick floor slab and 12 inch thick by 10 foot high walls (Ref. 19).

The analyses performed showed that Building 999 and the connecting vestibule are adequate to resist the dead, soil, and seismic loads; and meet American Concrete Institute (ACI) ACI-318-89 and University of California Research Laboratory (UCRL) UCRL-15910 requirements (Ref. 20).

Due to the structural concerns associated with Corridor C (as previously discussed), the tunnel providing access to Buildings 997 and 999, storage in Buildings 997 and 999 is currently prohibited by operations.

2.2.6 Building 996

Building 996 is an underground vault located northwest of Building 991 nearly identical to Building 997. Building 996 was built to withstand exceptionally high blast pressures. The exterior walls are 14 feet 6 inch thick reinforced concrete. The roof is 12 feet thick concrete with one to 10 feet of earth covering. The floors are six feet thick concrete and the interior partitions are two feet thick concrete. The outside dimensions of the building are 60 feet by 68 feet. The building has four main storage areas, which are 12 feet wide by 18 feet 6 inches long by 10 feet high. The original design criteria of Building 996 required the structure to support specific dead loads and to withstand the blast pressure of a semi-armor piercing 2,000 pound bomb (1,000 pounds per square foot blast pressure and 18.7 inches diameter, 1,100 feet per second inert penetration). For Building 996 this criteria included a direct-hit penetration resistance (Ref. 1 and 14). Building 996 is a massive structure and a structural evaluation performed in 1979 indicated that the structural components are capable of withstanding the seismic loads from a DBE. The building, being underground, is not subject to tornado or wind loading, or impact from tornado-driven missiles (Ref. 15 and 16).

Vertical cracks in the lintel sections have been noted over all of the doorways in Building 996. The concrete cracking in the lintels of the interior walls of Building 996 has been attributed to shrinkage cracks resulting from the original mass concrete placement. The 12 foot thick concrete slab over each lintel was determined to be capable of readily arching all loads over these spans, eliminating structural capacity concerns due to the cracking (Ref. 17). In August 1992 a review of the Agbabian calculations as well as additional checks, indicated that Building 996 met existing conventional and natural phenomena load requirements (Ref. 18).

2.2.7 Corridor B

Corridor B, also known as Tunnel 996, is a reinforced concrete structure that connects Building 991 north and west to Building 996 and to the east end of Corridor C. The corridor is an inverted Y-shaped underground corridor 10 to 12 feet wide and 11 to 13 feet high.

Corridor B, between Building 991 and Building 996, is secured to Building 991 but the connection at Building 996 allows motion of the corridor relative to Building 996 along the corridor axis. Since the corridor, Building 996, and the northern portion of Building 991 are below grade, they will move with the ground during an earthquake and therefore differential displacement between Building 991 and Building 996 transverse to Corridor B is not expected to be large enough to cause any damage to the tunnel or either building. Differential displacement between Building 991 and Building 996 along the corridor axis would be minimized by soil friction and again no damage to the corridor is envisioned. Corridor B, being underground, is not subject to tornado or winds loading, or impact from tornado-driven missiles. (Ref. 15).

2.2.8 Building 998

Building 998 consists of a vault-like structure (Room 300) and a corridor connecting Building 991 to Room 300. The corridor is referred to as either Corridor A or Tunnel 998.

Room 300 is located north of Building 991 and connected to it by Corridor A. The room has exterior dimensions of approximately 30 feet by 20 feet with two feet six inch thick reinforced concrete walls, floor, and roof. The earth cover over Room 300 is up to 14 feet in depth. Room 300 was found to be capable of withstanding the criterion seismic loading of 0.14 g horizontal acceleration at bedrock level. The room, being underground, is not subject to tornado or wind loading, or impact from tornado-driven missiles. (Ref. 15).

Corridor A, also known as Tunnel 998, is an underground, reinforced concrete structure connecting Room 300 to Building 991. The tunnel is seven feet six inches wide and 180 feet long. The walls, roof and floor of the tunnel are 15 inches thick. The earth cover is estimated at a maximum of 18 feet.

Corridor A is keyed to both Room 300 and Building 991. Since Room 300, the corridor, and the northern part of Building 991 are below grade, they will move with the ground during an earthquake and therefore differential displacement between the two buildings transverse to the corridor is not expected to be large enough to cause any damage to the corridor or either building. Differential displacement between the two buildings along the corridor axis would be minimized by soil friction and again no damage to the corridor or buildings is envisioned. Corridor A, being underground, is not subject to tornado or winds loading, or impact from tornado-driven missiles. (Ref. 15).

A structural evaluation (Ref. 21) of Building 998 was performed to assess the structural integrity of Room 300 and Corridor A due to the depth of overburden soil load. The evaluation consisted of a review of the structural drawings and inspection of the Room 300 and corridor structures. The inspection of Room 300 revealed that the concrete walls are in very good condition. No signs of any structural stress was noted during the inspection. The inspection of Corridor A indicated that the concrete walls are in very good condition. There were no appearance of any structural overstress cracks. The only problem noted with Corridor A was the hair line transverse cracks in the ceiling and walls at about the center of the length of the corridor. These cracks are near the transverse construction joint that has a rubber membrane to keep water from leaking through. Both the cracks and construction joint have leaked in the past. The evaluation concluded that since the condition of Room 300 and Corridor A is good with the present loads, and since no additional loads are planned, it is justifiable to certify the these areas as structurally safe. (Ref. 21).

2.2.9 Building 985

Building 985 is a 2,400 square foot filter plenum facility, constructed in 1972. It is a one-story structure adjacent to the northwest corner of Building 991. At the east end of the building is a pit in which there is a tank for collecting water that would result from activation of the plenum fire protection sprays. There are no Raschig rings in the tank.

Building 985 is approximately 60 feet long by 40 feet wide by 15 feet high. The foundation of the building consists of 16 concrete caissons with two foot, 2½ foot, and 3 foot diameters and lengths varying from 13 feet to 34 feet. The caissons support reinforced concrete grade beams 12 inches thick and five feet deep for interior walls and five feet three inches deep for exterior walls. The floor slab is reinforced concrete eight inches thick on ground, nominally 11 inches thick for pads, and an average 12 inches thick for the sloping pit slab.

The pit walls are 12-inch thick reinforced concrete with an average height of 13 feet. The exterior walls of the building are pre-cast concrete, six inches thick. Pre-cast concrete walls are over 13 feet high. Cast-in-place straight wall and corner wall connections and continuous perimeter concrete roof beams bond the walls together.

The main roof is precut concrete, twin tee construction with a two inch thick wire mesh reinforced concrete topping, 1½ inch thick insulation, and built-up roofing. The airlock roofs are cast-in-place concrete.

Structural framing is poor due to excessive ground erosion at the west end and south side of the building. The entryway and walkway is sinking and pulling away from the building (Ref. 5). This condition has no effect on the function of the filter plenum system. The drainage system between Buildings 985 and 991 does not have an outlet, causing standing water to collect between the two buildings. The water then seeps into the ventilation control room and into Corridor B between Building 991 and Building 996 (Ref. 5). There is no waste storage in either of these locations.

Precautions to protect against freezing were taken in 1991 by installing a portable heater to protect the fire water lines. This action was considered necessary since in 1990, fire water lines froze causing approximately 10,000 gallons of water to discharge into the pit (Ref. 5).

2.2.10 Building 989

Building 989, the Diesel Generator Facility, is a one-story structure located just east of Building 991. It was built in 1973 and has dimensions of 24 feet long by 16 feet wide by 12 feet high. The foundation is a reinforced concrete floor slab on ground reinforced with two layers of welded wire mesh. The walls above grade are eight inch thick concrete block. The building has a double-sloping, reinforced concrete roof slab, five inches thick on one side and nine inches on the opposite side. The roof slab is covered with 1½ inches of insulation and finished with built-up roofing.

Building 989 houses a 256 kilowatt (kW) generator, diesel engine, a 180 gallon diesel fuel oil day tank, starting batteries and associated charger for the diesel engine, generator control panel, and the remainder of the equipment necessary for the operation of the diesel generator. An exhaust fan in the west wall of the building cools the building when the generator is in operation. Building 989 is heated by two 7 kW electric heaters in the north end of the building. The exhaust fan and heaters maintain the diesel generator and the associated equipment within temperature limits required for proper operation. Automatic fire protection for Building 989 and the equipment within is provided by water sprinkler heads (dry-pipe automatic sprinkler system) in the ceiling above the equipment.

The structural framing is poor due to ground erosion on the east side of the building. Leaks are evident along the upper portion of the walls because of the erosion. Several oil leaks were noted around the generator. All other systems were rated as adequate. The diesel generator is operational (Ref. 5).

There is a 3,000-gallon underground diesel fuel storage tank approximately 10 feet east of the generator building. This tank was closed in place using a closed cell polyurethane foam (Ref. 22). A 1,000-gallon, above-ground fiberglass tank was put into service in May of 1997 to replace the underground tank.

2.2.11 Building 984

Building 984 is located just south of Building 991. This 3,200 square foot building is constructed of concrete floors, metal walls and a metal roof. The building has electric lights but no heat, no alarms, no fire suppression system, and no plenums. The building houses the drum crushing operation for the Building 991 Complex. After the drums are crushed they are placed in wooden waste containers and stored under the Building 991 canopy until they can be shipped off-site. Storage of low-level waste is not permitted in the building.

2.2.12 Building 992

Building 992 is a two-story concrete Guard Post located south of Building 991. The building is no longer used as a guard post and is normally unoccupied.

2.3 COMPLEX SYSTEMS AND COMPONENTS

System descriptions are provided for the various systems in Building 991. The detail provided for each system is dependent on the classification of the system based on the hazard and accident analysis. More detail is provided for those identified System Category (SC)-1/2 and SC-3 SSCs and less for other SSCs . Chapter 5 and Appendix A provide additional details on the boundaries, support systems and interfaces of the systems, and establishes the functional requirements and acceptance criteria of the SSCs identified as SC-1/2 and SC-3 SSCs from the safety analysis in Nuclear Safety Technical Report (NSTR)-011-98 (Ref. 23).

2.3.1 Fire Suppression, Detection, and Alarm System

This description of the fire suppression, detection, and alarm system in the Building 991 Complex was compiled from information contained in the Fire Hazards Analysis (FHA) (Ref. 24), walkdowns, and interviews with Operations and Fire Protection personnel.

The automatic sprinkler provides suppression in the event of a large fire. The Limiting Conditions for Operations (LCO) requirements in the FSAR are applicable to those portions of the automatic sprinkler system that protect the Building 991 Complex radioactive waste storage areas and those areas used in the receipt and shipment of radioactive waste containers. These areas contain significant quantities of source term materials (material-at-risk (MAR)) that could result in release of contamination during a fire. As discussed in this FSAR, these areas are protected by Riser Systems A and B. Riser System A also provides fire suppression to areas that do not provide radioactive waste storage or receipt/shipment of radioactive waste. This includes the Building 991 basement, the office area, the Building 991 roof plenum deluge system, and Building 989. The fire detection and alarm system provides detection of fire, actuation of an automatic suppression system, and transmittal of alarm to the Central Alarm Station (CAS) and Fire Dispatch Center (FDC).

The fire suppression, detection, and alarm systems in the Building 991 Complex include the following systems and are discussed below:

- Fire water supply
- Automatic sprinkler systems
- Deluge systems
- Heat Detection System

- Smoke Detection System
- Fire Phones
- Fire extinguishers

Figures 2-6 through 2-9 provide an overview of the floor plan of the Building 991 Complex and show the general location of the automatic sprinkler system zones and locations of the fire hydrants, post indicator valves (PIVs), fire extinguishers, Fire Department connections, fire phones, inspector's test connections, fire alarms, and fire detection systems.

A description of the fire suppression, detection and alarm system is provided below.

2.3.1.1 Fire Water Supply

The domestic cold water (DCW) system, as discussed in Section 2.3.5.4, supplies the water for the fire suppression systems for the Building 991 Complex. Major components of the fire water supply consist of lines from the Site DCW supply system, PIVs, fire hydrants, Fire Department connections, alarm check valves and distribution risers.

Two distribution risers support Building 991, including Building 998 (Room 300 and Corridor A) and Building 989. These risers are designated as Systems A and B respectively. The System A riser supports the wet pipe sprinkler system in Building 991 and a dry pipe system valve from this riser feeds the dry-pipe sprinkler system for the East Dock and Building 989. This system also supports the plenum deluge system for the Building 991 roof plenum. The System B riser supports the dry-pipe sprinkler system for the West Dock and the canopy area. A third distribution riser supports Building 985. The fire suppression systems supported by each fire water supply system are shown in Figures 2-6 through 2-9. For Riser System A and Building 985 the water enters the building at the risers and passes through the alarm check valve on its way to a retard chamber with a pressure-operated alarm switch and to the sprinkler system piping. For Riser System B the water enters the building at the riser and, once the air pressure has been reduced due to system activation, passes through to the sprinkler system piping. A PIV at each line is normally locked in the open position but can be closed to isolate the supply line.

Building 991 contains a horizontal standpipe system with eight 1-½-inch hose connections for Fire Department use for System A. Hoses, racks, and nozzles have been removed from these locations. There are no hose stations requiring support from System B. The Fire Department connections for Systems A and B, located on the southwest corner of Building 991, consist of Siamese (dual) 2-1/2-inch inlets that supply the sprinkler system or hose stations. The connections are marked to indicate whether they supply sprinklers or hose stations. Check valves keep water that is being pumped into the building hose station Fire Department connections from charging the sprinkler system. The Building 985 Fire Department connections are located on the south side of the building. A single connection is provided for the hose station and a Siamese (dual) 2-1/2-inch inlet is provided for the sprinklers.

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Table 2-1 Fire Suppression Systems and Coverage

System	Coverage
System A (riser located in basement)	Basement
	Building 991 Waste Storage Areas
	Supply to the East Dock and Building 989 dry pipe system
	Building 998 (Corridor A and Room 300)
	Building 991 office areas, mechanical rooms
	Building 991 Roof Plenum Deluge System
	All hose valves in these areas
System B (riser located in Room 170 – West Dock)	Supply to the West Dock and Canopy area
Building 985 riser	Building 985
	Building 985 filter plenum deluge system
	All hose valves in Building 985.

There are two accessible fire hydrants located within 75 feet of Building 991 of the Building 991 Complex and one located within 75 feet of Building 985. See Figure 2-10 for the Building 991 Complex for the fire protection water loop with hydrant locations. These hydrants are identified as Hydrants 9-3, 9-4 and 9-5. Hydrant 9-3 is located directly west of Building 985 on the west side of the north-south running road and provides access to pump into the sprinkler system and standpipe Fire Department connections located on the south side of Building 985. Hydrant 9-4 is positioned near the southwest corner of Building 991 and provides access to pump into the sprinkler system and standpipe Fire Department connections located on the west side of the building and also provides access to Building 992 and Building 984. Buildings 996, 997 and 999 could also be supported by this hydrant or they could be accessed from within Building 991. Hydrant 9-5 is located near the southeast corner of Building 991 and is in a useful position for interior attack of the Building 991 office areas, mechanical rooms, basement, and waste storage areas in Rooms 134 and 166, and Buildings 989 and 984. These fire hydrants provide adequate coverage of the complex.

2.3.1.2 Automatic Sprinkler System

Portions of Building 991, Building 998, and the basement level are protected by an overhead automatic wet-pipe sprinkler system, designated as System A. Building 985 is also protected by an overhead automatic wet-pipe sprinkler system. The wet-pipe sprinkler systems were installed to an Ordinary Hazard pipe schedule per NFPA 13. The "Ordinary Hazard" classification requires a minimum residual pressure of 20 pounds per square inch (psi) plus elevation to the highest sprinkler (approximately 27 psi for Building 991) and a required flow rate at the base of the riser of 850 to 1500 gallons per minute (gpm). Per the FHA (Ref. 24), the available pressure and flow rates for the sprinkler systems in Building 991 exceed the required minimum for pipe schedule systems: (1) for Ordinary Hazard Group II occupancy under the 1989 edition of NFPA 13, and (2) for Ordinary Hazard occupancy under the 1994 edition of NFPA 13.

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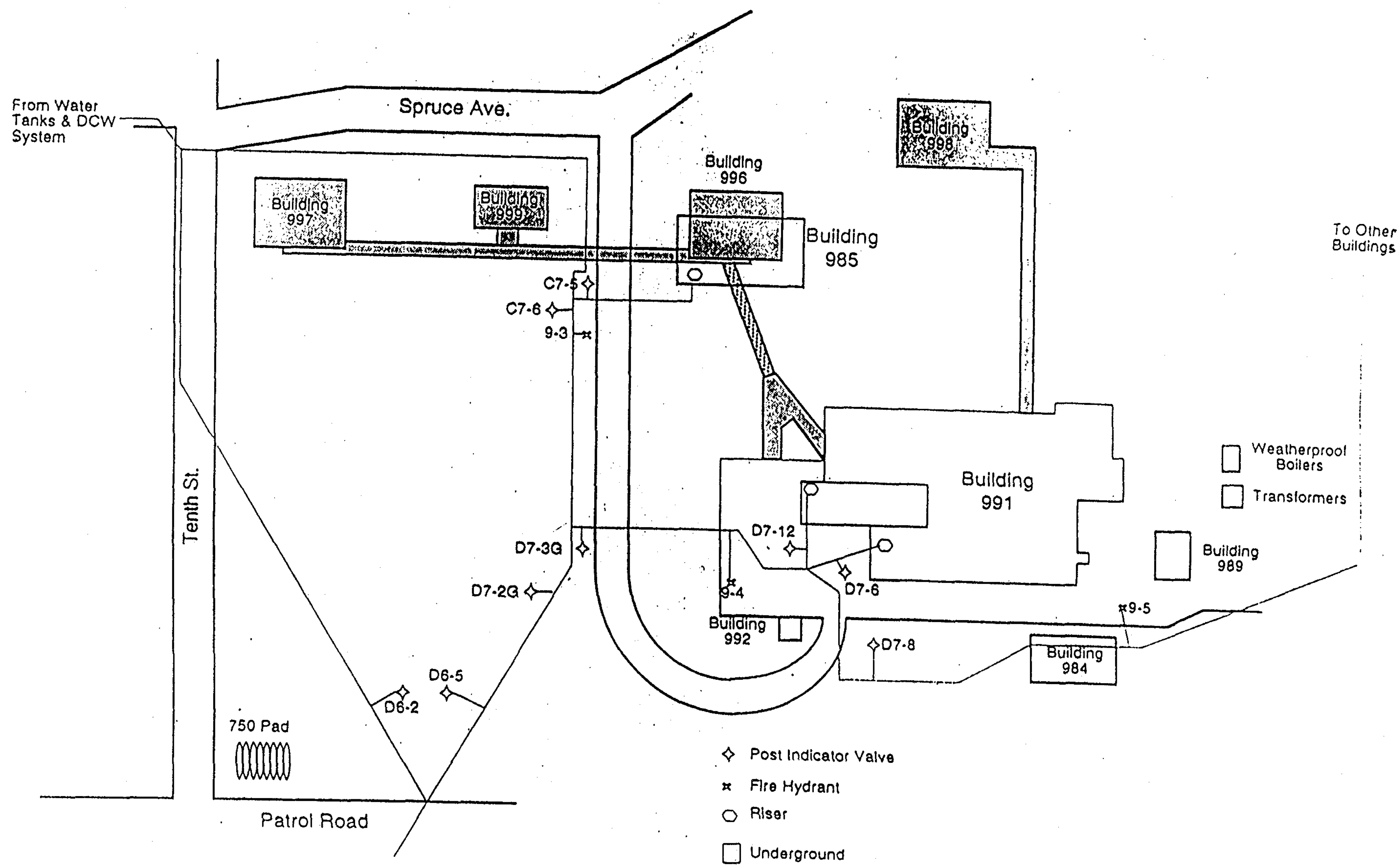

Figure 2-10 Building 991 Complex Fire Protection Water Loop

The sprinkler system consists of a series of pipes with discharge nozzles (sprinklers) located throughout the building. The pipes are under water pressure at all times. When a fire occurs, heat rising from the fire causes individual sprinklers to fuse as they are heated to their design temperature. The water impinges on the sprinkler deflector to produce a uniform spray pattern. The resulting flow of water is detected by the pressure switch on the alarm check valve (located on the System A and Building 985 risers) which initiates a fire alarm to the FDC and CAS. Figure 2-11 is a flow diagram of the Fire Suppression System for System A and the Building 985 riser system. The sprinkler system begins immediately downstream of the PIV in the fire water supply line. At the point the water supply piping enters the building, alarm check valves are installed to detect the flow of water. The alarm check valves incorporate a clapper that lifts from its seat when water flows through the system. As the clapper lifts, it uncovers a passageway to an alarm port through which water flows to a retard chamber on its way to a pressure-operated alarm switch and a water motor gong. The clapper in the alarm valve also acts as a check valve to minimize water hammer actions and to minimize the possibility of contaminating the domestic cold water system with water normally held stagnant in the fire protection system. Comparing the system pressure reading taken with the valve closed (static pressure) to a reading with the main drain fully open (residual pressure) provides an indication of the water supply availability and the condition of the supply piping. Surveillances on the system will compare the static pressure of the system from month to month to ensure there is no change in the condition of the water supply to the building.

To help reduce false alarms caused by pressure surges and accompanying small movements of water in the system, water from the alarm port on the alarm valve passes through a retard chamber. The drain is smaller than the alarm port and piping allowing the retard chamber to fill while also allowing a small amount of water to drain. The time it takes for the water to fill the chamber is the amount of retard time provided for the system. Once the chamber is filled, the water activates a pressure-operated switch. The pressure-operated switch is wired directly to a SIO panel that transmits a signal to the FDC and CAS. The water also turns a water wheel that provides a local alarm by operating a striking mechanism that repeatedly strikes a water motor gong mounted on the outside wall of the building. Once the water stops flowing, the retard chamber drains so that it is ready to be used the next time the alarm check valve clapper opens. The Building 991 fire bells are not activated when the automatic wet-pipe systems operate.

The sprinkler riser systems have inspector's test connections. Each inspector's test connection allows a flow rate equivalent to the flow from one sprinkler head. Opening the inspector's test connection verifies that water can flow through the system and tests the operation of the alarm valve. Inspector test connections are as shown in Figures 2-6 and 2-9.

The Fire Department can also supply water to the sprinkler systems in Building 991 and Building 985 through fire department connections located on the outside southwest wall of the Building 991 and on the outside south wall of Building 985. The fire department connections for Building 991 consist of Siamese (dual) 2-1/2-inch inlets that supply the sprinkler system and the hose stations. Building 985 has two fire department connections, a single one for the hose reels and a Siamese (dual) inlet that supplies the sprinkler system. The Fire Department can

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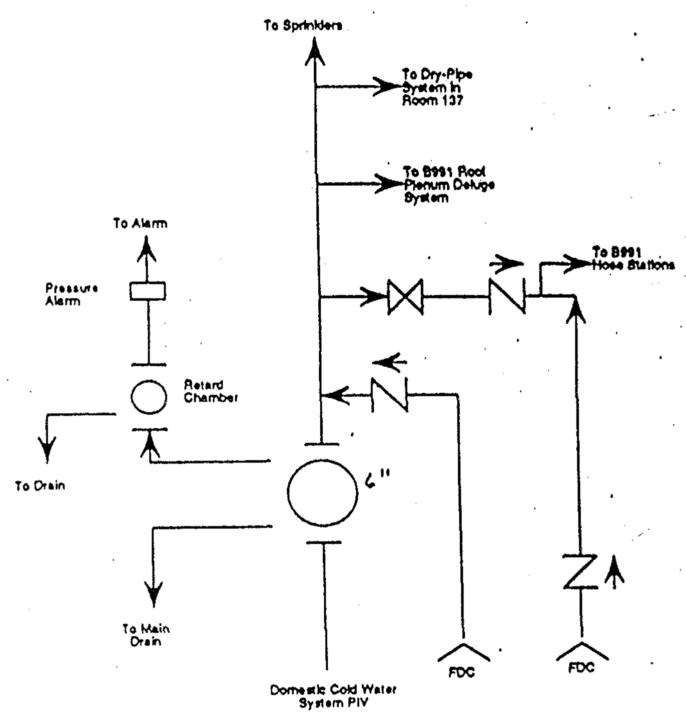
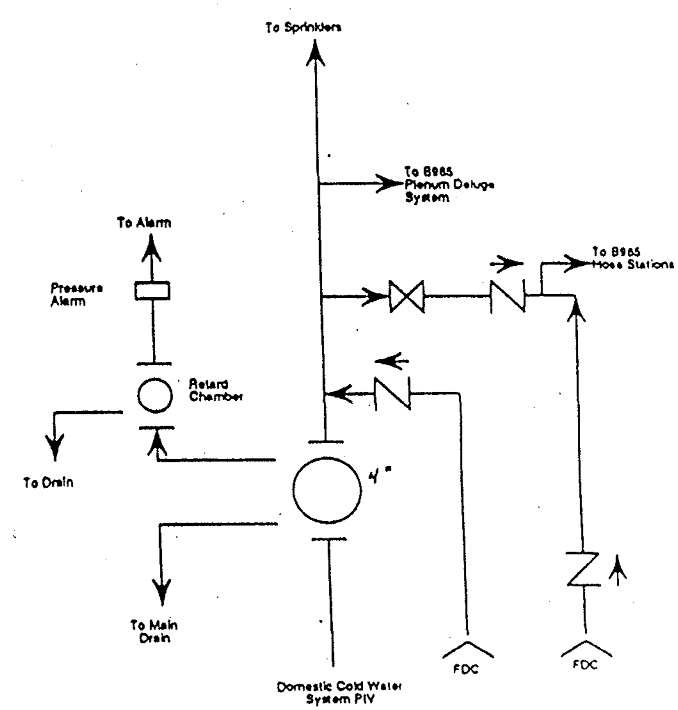


Building 991 Riser System A
Wet Pipe Sprinkler System



Building 985 Riser System Wet Pipe
Sprinkler System

Figure 2-11 Fire Suppression System Flow Diagram Riser System A and Building 985 System Riser

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connect hoses to a hydrant and flow water through pumper vehicles to the fire department connections to boost the water pressure and volume in the system to create a greater capacity for controlling or extinguishing a fire.

In the event of loss of electrical power, the Building 991 fire alarm and plenum deluge systems have backup supplies from 24 volt batteries, plus additional backup from the diesel generator. The Building 985 plenum deluge system, bell control, and the tunnel smoke detectors are not provided with diesel generator backup capability. The smoke detectors have an eight hour battery backup capability and the fire alarm panels are provided with a four hour battery backup capability. The fire alarm system is periodically tested by the Fire Department to ensure they will function in an emergency.

The automatic sprinkler system risers for System A and Building 985 also supply water to the hose connection stations for manual fire fighting. The pipes that deliver water to the hose connection stations are interconnected to the sprinkler system piping through a check valve. Hose stations are not equipped with hoses - hoses are brought to the stations by the Fire Department.

2.3.1.3 Dry Pipe Sprinkler System

The Building 991 Complex also has areas subject to freezing conditions, therefore, fire protection is provided by an automatic dry-pipe sprinkler system in these areas. The areas protected by the dry-pipe system include the East Dock and Building 989 (this dry-pipe system valve is fed from System A) and the enclosed west dock area and the external canopy area (fed from System B). The riser system flow diagram is detailed in Figure 2-12. The section of pipe that is subject to freezing contains air under pressure. The air pressure required for each system is dependent upon pipe size and manufacturer of the system. For the dry-pipe system supported by System A, an acceptable static pressure is 35 - 50 psig. For the System B dry-pipe sprinkler system, an acceptable static pressure is 25 - 45 psig. The compressed air in these systems holds the dry pipe riser clapper closed preventing water from entering the upper portion of the dry pipe riser. When a sprinkler head fuses, air exhausts from the pipe reducing the pressure on the air side of the dry pipe valve. Water pressure lifts the clapper inside the dry pipe valve, allowing water to flow through the piping and to the sprinkler heads.

Activation of the dry-pipe system will send a signal to the CAS/FDC and will also activate the pressure switch on the respective riser alarm check valve which will activate the water gong for the system.

2.3.1.4 Plenum Deluge Systems

There are two plenum deluge systems for the Building 991 Complex, the Building 991 roof plenum and Building 985 plenum. The filter plenum deluge systems employ open nozzles inside the plenums attached to a piping system supplied by deluge valves. When a deluge valve opens, water flows into the piping system and discharges from all associated nozzles. Flow diagrams for the plenum deluge systems are presented in Figures 2-13 and 2-14.

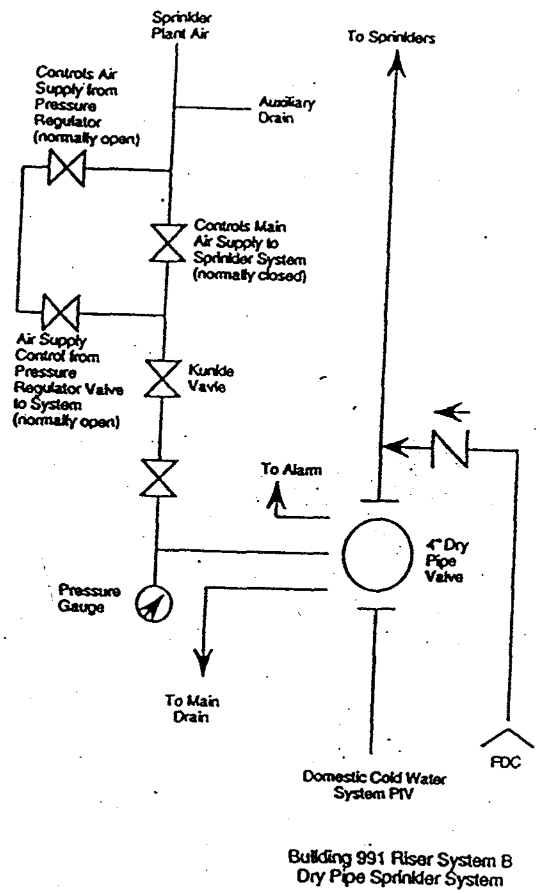

Figure 2-12 Fire Suppression System Flow Diagram Riser System B

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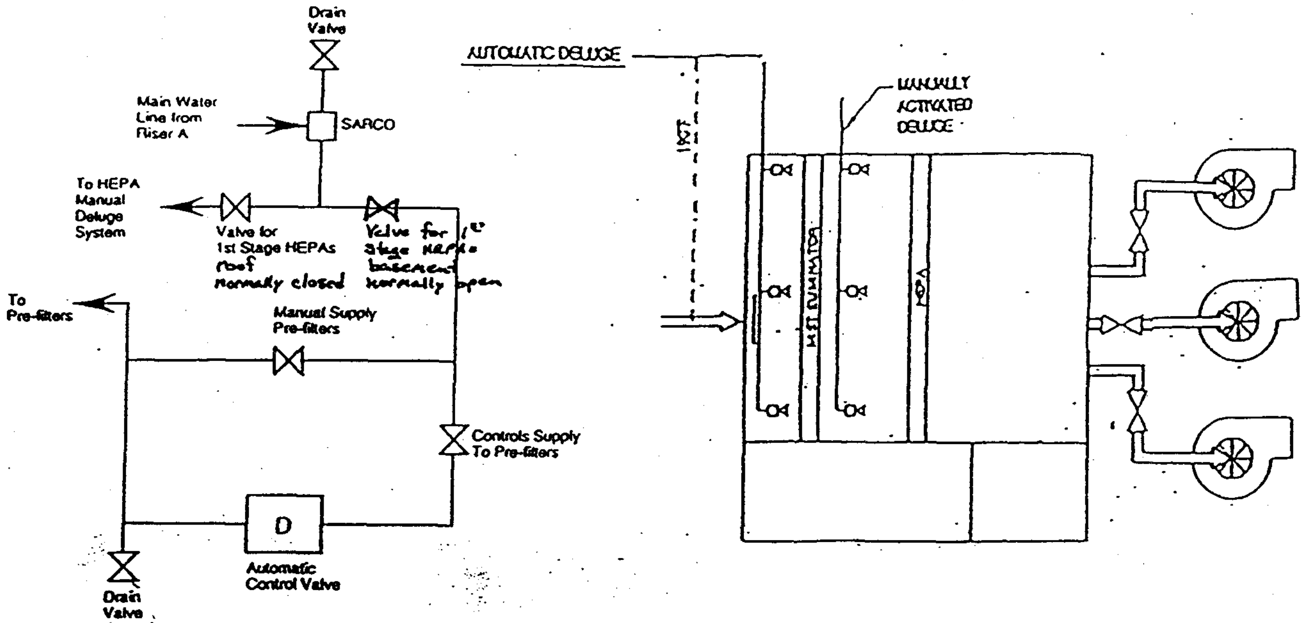

Figure 2-13 Building 991 Roof Plenum Deluge System Flow Diagram

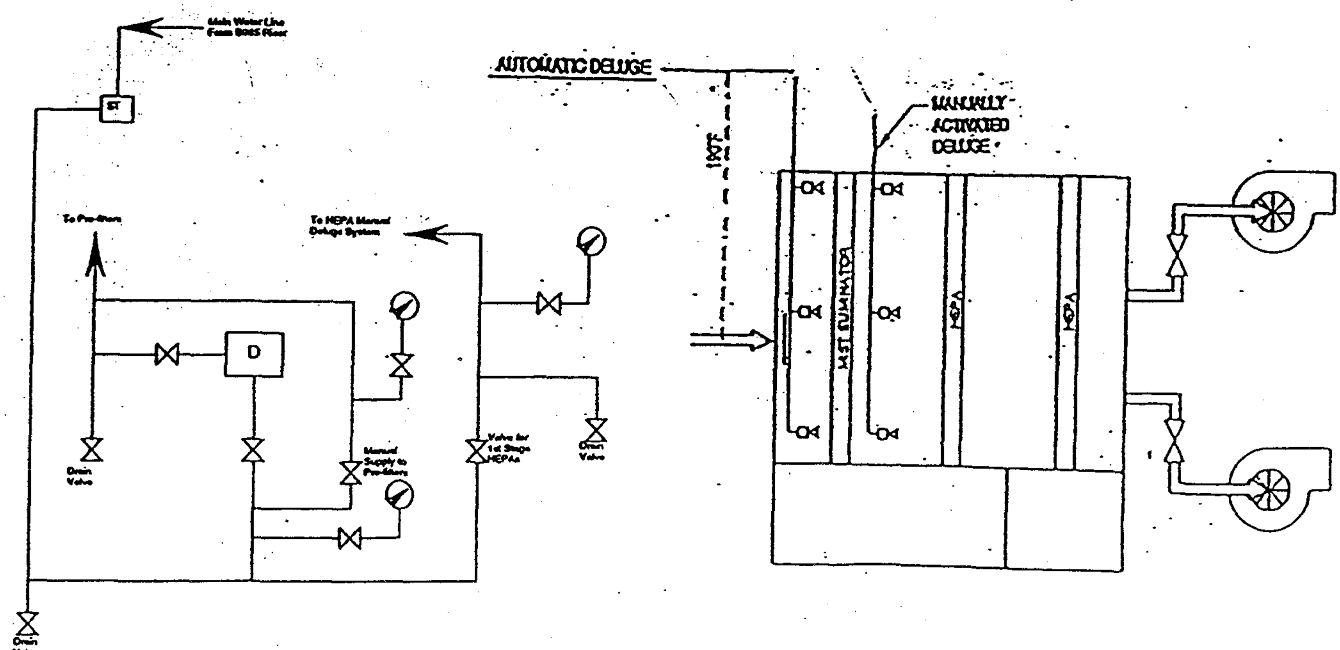

Figure 2-14 Building 985 Filter Plenum Deluge System Flow Diagram

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Each plenum has two systems, an automatic deluge system at the particle impingement separation screens (demister screen) and a manually activated deluge system upstream of the first stage of HEPA filters. The Building 991 roof plenum only has one stage of HEPA filters while the Building 985 plenum has two stages of HEPAs.

The demister chambers for the Building 991 roof plenum and Building 985 are shown in Figures 2-13 and 2-14. These chambers have nozzles located approximately six inches upstream of the demister screen. The spray pattern is designed so that a water curtain is discharged to cool the incoming air. The spray may also facilitate particulate removal. The capability to observe spray patterns of the automatic portion of the deluge system in the Building 991 roof plenum is significantly impaired due to the close proximity of the filter stage to the plenum wall. That is, the inlet plenum wall is very close to the filter stage blocking view of some of the spray nozzles due to limitations of line of sight. Also, nozzle sprays near observation ports degrade the visibility of the spray for nozzles further away from the observation port. The automatic plenum deluge systems are defense-in-depth systems and are not credited controls in the safety analysis. The adequacy of this configuration for a credited safety system would be questionable since nozzle spray patterns for some portions of the plenum may not mitigate high air temperature or hot ember and flying brand impacts on filters (i.e., certain areas of the filter stage may not be cooled or protected against hot particulates). Heat detectors located in the inlet ducts to the filter plenum actuate the automatic deluge valves. When high temperature air passes over the heat detector, the contacts within the detector change state at 190°F, which sends a signal to the associated deluge control panel. The deluge control panel for the Building 991 roof plenum is located in Room 130 and the panel for the Building 985 plenum deluge system is located in Building 985. The deluge control panel simultaneously sends an alarm to the CAS and FDC (via the Signal Input / Output (SIO) panel), sends an alarm to the deluge control panel, and sends a signal to the solenoid that opens the automatic deluge valve. The deluge control panels have batteries that provide backup power to the panel if alternating current (AC) power is lost. The circuitry is supervised. A supervisory alarm is received at the FDC when AC or direct current (DC) power is lost. The demister screens remove much of the water from the air stream before it reaches the HEPA filters to protect the filtration capability of the filters.

The manually activated deluge system is located immediately upstream of the first stage of HEPA filters. Deluge nozzles spray water directly onto the first stage of HEPA filters. The manual deluge system provides an important emergency capability if the first stage of HEPA filters is in danger of being consumed by fire. Activation of the system under such conditions, however, will likely result in the loss of the first stage, either due to plugging by soaked particulates (which will effectively stop ventilation), by partial plugging causing media failure, or by direct damage. Failure of the first stage other than by plugging will subject remaining downstream stages to the possibility of fire, heat, or physical damage.

The hazard and accident analysis credits the filtered exhaust ventilation systems in Building 991 and Building 985. The automatic plenum deluge systems are identified as defense-in-depth systems for the filtered exhaust ventilation systems but are not credited in the safety analysis. The systems are to be maintained in their current configuration (i.e., not allowed to degrade any further than is currently realized) as added assurance for protection of the HEPA

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filters against the impacts of larger fires than those analyzed in the safety analysis. Department of Energy (DOE)/Rocky Flats Field Office (RFFO) has directed that further testing of the Building 991 and Building 985 plenum deluge systems be discontinued due to the potential for damaging the HEPA filters (Ref. 25). This testing is to be discontinued until an alternative means of testing is developed. The HEPA filters in both the Building 991 and Building 985 systems were initially installed in 1984. Testing of the manual plenum deluge system has occurred since 1984 that wetted the first stage of filters. In 1990 approximately 20 of the 96 Building 991 roof plenum HEPA filters were replaced. The first stage HEPA filters for both plenums are considered suspect since they have been wetted. The manual plenum deluge systems were last flow tested in March 1995.

2.3.1.5 Heat Detection System

The heat detector changes state and transmits a signal if the temperature exceeds a design value. Depending on the configuration of the system, the signal transmitted from the heat detector is used to activate local alarms (visual or audible), notify the CAS and the FDC, or actuate a suppression system.

The detection device in the automatic sprinkler system is the sprinkler head. A sprinkler can be considered a combined heat-activated fire detector and extinguishing device when the sprinkler system is provided with waterflow indicators connected to the fire alarm control system. The sprinkler system was designed and installed in accordance with NFPA 13 according to the Ordinary Hazard pipe schedule method. When a fire occurs, heat rising from the fire causes individual sprinklers to fuse as they are heated to their design temperature. The resulting flow of water is detected by the pressure-operated switch in the alarm valve, which initiates a fire alarm.

Heat detectors located in the inlet ducts to the filter plenum actuate the automatic deluge valves. When high temperature air passes over the heat detector, the contacts within the detector change state at 190°F, which sends a signal to the associated deluge control panel. The deluge control panel for the Building 991 roof plenum is located in Room 130 and the panel for the Building 985 plenum deluge system is located in Building 985. The deluge control panel simultaneously sends an alarm to the FDC (via the SIO panel), sends an alarm to the deluge control panel, and sends a signal to the solenoid that opens the automatic deluge valve. The deluge control panels have batteries that provide backup power to the panel if AC power is lost. The circuitry is supervised. A supervisory alarm is received at the FDC when AC or DC power is lost. The testability of the heat detectors of the Building 991 automatic plenum deluge system has degraded since initial installation. The three plenum intake ducts each have three heat detectors equally spaced around the duct. The testing apparatus for some of the nine heat detectors (five of the nine currently) is no longer available due to cable exposures to the elements over the years. At least one heat detector in each intake duct is testable. The adequacy of this configuration for a credited safety system is questionable since a single heat detector in the intake duct may not be able to detect all situations of high intake duct air temperatures (i.e., the heated air may "hug" a wall of the duct rather than mix yielding lower air temperature readings by a heat detector outside of the heat air stream).

2.3.1.6 Smoke Detection System

Buildings 996, 997, and 999 (including Corridors B and C) are provided with Pyrotronics high-voltage DC ionization smoke detectors (a smoke detection system is not required per NFPA 101 for these buildings and corridors). An ionization smoke detector has a small amount of radioactive material that ionizes the air in the sensing chamber, rendering the air conductive and permitting a current flow through the air between two charged electrodes. This gives the sensing chamber an effective electrical conductance. When smoke particles enter the ionization area, they decrease the conductance of the air by attaching themselves to the ions, causing a reduction in ion mobility. When the conductance is below a predetermined level, the detector responds. A signal from the detector is transmitted to the alarm panel in Room 402 of Building 991. The signal transmitted from the smoke detector is used to notify the CAS and the FDC and to activate an alarm in the alarm panel. A fire annunciator panel is located in the office area of Building 991 for the smoke detection system. This panel receives a signal when the smoke detector is initiated and is used by the Fire Department to see where the fire is located in Buildings 996, 997, and 999.

The detectors receive power from the electrical power system through the fire panel. The fire panel circuitry is supervised. A trouble signal is received at the FDC when AC or DC power to the panel is lost. The Pyrotronics smoke detectors have approximately 24 hours of battery capacity. The smoke detectors are tested periodically by the Fire Department to be sure they will function in an emergency.

2.3.1.7 Fire Phones

Fire phones are located throughout the Building 991 Complex as shown in Figures 2-6 through 2-8. Fire phones are not a detection system, however, fire phones allow building personnel to sound a local fire alarm and transmit an alarm to the CAS and the FDC when fire or other abnormal conditions exist with the building.

When the fire phone receiver is lifted, a signal is sent to the local bell panel, which activates the building fire bells. The bell panel receives power from the electrical power system and is also supplied with batteries that provide a secondary power supply. A separate signal is sent via the SIO panel to the CAS and to the FDC. If personnel are unable to stay at the phone, a distinct alarm point at the CAS and the FDC identifies the location of the phone.

2.3.1.8 Fire Extinguishers

Fire extinguishers are located throughout the Building 991 Complex as shown in Figures 2-6 through 2-9. The fire extinguishers are either dry chemical or liquefied gas and are rated for Class ABC fires.

2.3.2 Heating, Ventilation, and Air Conditioning

This system description provides an overview of the Building 991 Complex heating, ventilating, and air conditioning (HVAC) system. This description is based on information provided by system operators and on walkdowns of the complex. Functional requirements of this system are specified in Chapter 5. Functions described in this section, but not in Chapter 5, are not required for FSAR compliance but may be required for other regulatory or worker-safety purposes.

This system description discusses the supply systems, the exhaust systems, heating system and chilled water system in place in the Building 991 Complex.

2.3.2.1 HVAC Supply Systems

The Building 991 Complex is divided into six supply zones as indicated in Figure 2-15. A discussion of the functioning of each zone is provided below. All of the supply systems were shut down during the walkdowns of the facility.

Supply Zone 1 (S-1)

The supply fan for supply zone 1 is located in Room 130 and supplies ventilation to the north side of the building (Rooms 140 through 154, Rooms 156 through 165, and Building 998 (Room 300 and Corridor A). The S-1 supply system is currently not operational due to non-functional preheat and reheat coils. The system could be used in the summer months if required.

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PERSONNEL WITH ACCESS TO
UNCLASSIFIED CONTROLLED
NUCLEAR INFORMATION (UCNI)
MAY OBTAIN THIS INFORMATION
FROM THE
BUILDING 991 CLUSTER
CLOSURE PROJECT MANAGER

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The S-1 system has outside air dampers that open when the fan is started. The supply air then passes through a preheat coil that operates if the outside air temperature is below 60°F. A controller is located on the north side of Room 137 that will start a pump (P-7) to supply heating water to all of the supply preheat coils at an outside air temperature of 60°F. A controller located on the East Dock starts a circulating pump (P-1) for the S-1 preheat coil below 60°F outside air temperature and circulates heating water to a pneumatic operated three-way valve and preheat coil. A controller on the north wall of Room 130 controls the position of the three-way valve to maintain 60°F air leaving the preheat coil. The system contains a freezestat that is used to shutdown the S-1 fan and shut the dampers if the coil discharge temperature drops below 35°F. If the freezestat engages it must be reset before the supply fan can be restarted. After passing through the preheat coils, the supply air then passes through a single stage of furnace filters and then to an air conditioning D/X coil. A liquid line solenoid valve is set to open if the outside air temperature is above 55°F to provide cooling for the system. A two-stage controller (T-2) located on the East Dock, will start the P-1 heating pump below 60°F and the air conditioning above 55°F. The supply air then passes through the fan and to the hot deck/coil section. The "hot deck" temperature controller is mounted on the side of the plenum and controls the flow of heating water to the coil. Pump P-2, located in Room 137, operates to supply heating water to the hot deck coil.

The hot deck/cold deck section supplies nine zones each with dampers to regulate the mix of air to control room temperature. Each zone control consists of a room thermostat that will reset the zone submaster controller that will in turn position the damper for the desired mix of supply air. All of the zone submaster controllers are located under the S-1 plenum at the west wall of Room 130. Room thermostats are located as follows:

Zone 1	Room 157
Zone 2	Room 158
Zone 3	Room 140 East
Zone 4	Room 140 West
Zone 5	Room 141 East
Zone 6	Room 141 West
Zone 7	Building 998 North Tunnel
Zone 8	Room 138
Zone 9	Room 153

The S-1 system is interlocked with exhaust system E-20 so that if E-20 stops S-1 will also stop.

Supply Zone 2 (S-2)

The supply fan for S-2 is located in Room 130 and supplies ventilation to Room 155.

S-2 draws outside air from the East Dock through a set of dampers that open when the system is started and into a preheat coil located above the dock door in Room 130. A controller (T-6) located on the East Dock will start a preheat pump (P-2) and circulate heating water through the coil and a three-way valve is used to control the air discharge from the coil. The three-way valve is modulated by a pneumatic controller located in the cabinet by the S-2 plenum. This control is set at 60°F. Pump P-7 operates to supply heating water to the preheat coils. A freezestat is located on the side of the duct to stop the S-2 fan and shut the outside dampers if the air discharge from the preheat coils drops below 35°F. If the freezestat engages it must be reset before the supply fan can be restarted. The supply air then enters the S-2 plenum, located at the west end of Room 130, and passes through a filter section and an air conditioning D/X coil. The air conditioning will start if the room temperature exceeds the set point of the room thermostat by way of the master controller in the cabinet by the S-2 plenum. The supply fan then discharges the conditioned air to Room 155 where is passes through a reheat coil and into the room. The reheat valve will admit heating water to the coil when the room temperature is less than the set point of the room thermostat by way of the master controller.

The S-2 system is interlocked with exhaust system E-24 so that if E-24 stops S-2 will also stop.

Supply Zone 3 (S-3)

The S-3 supply system is located in Room 130 and supplies ventilation to both sides of the south hallway from Rooms 110 and 123 east to Room 101. Room 101 is supplied by the S-4 supply system. The S-3 supply system is normally shut down during the winter months. The system has not been used for the past couple of years.

S-3 supplies air from the East Dock area through a set of pneumatic operated dampers that open when the fan is started. The air passes through a stage of furnace filters and into a preheat coil. A controller (T-11), located on the East Dock, will start pump P-3 by modulating a three-way valve if the air temperature drops below 55°F. Pump P-7 operates to supply heating water to the preheat coils. A freezestat is located on the side of the plenum to stop the S-3 fan and shut the outside dampers if the air discharge from the preheat coils drops below 35°F. If the freezestat engages it must be reset before the supply fan can be restarted. The supply air then passes through the chilled water coil for cooling if needed. The air conditioning system for S-3 is manually operated. If the air conditioning system is engaged, the chilled water pump (P-8) will circulate chilled water through a three-way valve and the chilled water coil. The three-way valve is controlled the controller in the control cabinet which is set to maintain a discharge air temperature of 55°F. The S-3 supply fan then discharges to the duct work supplying the rooms along the south hallway. Each room is supplied air through a reheat coil controlled by a room thermostat. Reheat pump P-5 operates to supply heating water to all of the reheat coils.

Supply Zone 4 (S-4)

The S-4 supply air system is located on the roof of Building 991 and supplies ventilation for Rooms 101, 132, 134, 135 and 136. The S-4 supply system has been inoperable for the past five years.

Outside air enters the S-4 plenum through a set of dampers that open when the fan is started. The air then passes through a stage of furnace filters and to a preheat coil. A controller, located on the East Dock, will start pump P-4 if the air temperature is less than 55°F and circulate heating water through a three-way valve and the preheat coils. A pneumatic controller located in the S-4 cabinet on the west wall of Room 130 will modulate the three-way valve for a discharge temperature of 55°F. Pump P-7 operates to supply heating water to the preheat coils. A freezestat is located on the side of the plenum to stop the S-4 fan and shut the outside dampers if the air discharge from the preheat coils drops below 35°F. If the freezestat engages it must be reset before the supply fan can be restarted. The supply air then passes through an air conditioning D/X coil for cooling if need. The air conditioning is controlled by the thermostat in the warmest zone by opening the liquid line solenoid valve to the D/X coil. The S-4 fan then discharges to the three zones through a reheat coil for each zone. Heating water to the coil is controlled by a room thermostat and a pneumatic valve. Reheat pump P-5 operates to supply heating water to the reheat coil.

Supply Zone 5 (S-5)

The S-5 supply system is located in Room 402 and supplies the Buildings 996, 997 and 999 (vaults and corridors). The S-5 supply system is inoperable due to need to replace belts.

This system draws outside air through a set of dampers that open when the fan is started. The air then passes through a stage of furnace filters and then through a heating coil that operates if the outside air temperature is less than 60°F. A heating water pump (P-5) circulates heating water through a three-way valve and the coil to control the fan discharge temperature to 60°F. A controller located on the plenum is used to sense the outside air temperature and start P-5 if the temperature drops below 60°F. Pump P-7 operates to supply heating water to the preheat coils. The supply fan discharges into the tunnel complex and supplies the rooms of the vaults. The S-5 system has no cooling or reheat coils.

S-5 is interlocked with the Building 985 exhaust fans such that if the exhaust fans stop, air supply from S-5 will stop.

Supply Zone 6 (S-6)

The S-6 supply system has been removed and the area it supplied on the north side of the building has been connected to Zone 6 and Zone 9 on the S-1 system.

Supply Zone 7 (S-7)

The S-7 supply system is located on the roof and supplies ventilation to the office area on the southwest corner of Building 991. This includes Rooms 111 through 122B. The S-7 supply system is normally only operated during the warm season.

Outside air enters the S-7 plenum through two sets of dampers. One set is the minimum fresh air dampers that open when the fan is started. The second set are modulated from a controller in the cabinet on the west wall of Room 130 that senses mixed air temperature. This controller is set at 55°F and modulates the outside recirculation and exhaust dampers to control mixed air temperature. The mixed air passes through a single stage of furnace filters and on to a D/X coil. The room thermostat sensing the warmest temperature will open the liquid line solenoid valve and start the air conditioning unit. The supply fan discharges into the supply duct which runs along the false ceiling above the hallway. Each room in this zone is supplied from the duct through a reheat coil. A pneumatic operated heating water valve supplies heating water to the coil as determined by the room thermostat. Pump P-5 operates to supply heating water to the preheat coils. A freezestat is located on the side of the mixed air plenum to stop the S-7 fan and shut the outside dampers if the air discharge from the preheat coils drops below 35°F. If the freezestat engages it must be reset before the supply fan can be restarted. A return air fan is also located on the roof of Building 991 and draws air from the office area and will either exhaust outside or recirculate this air depending on the position of the dampers. The return air is interlocked to run whenever the supply fan runs.

Building 985 Supply Zone

The supply system for Building 985 is not in use. The heating water coils have been drained and the system isolated.

2.3.2.2 HVAC Exhaust Systems

The Building 991 Complex exhaust system design is unique compare to other buildings at the Site. In this exhaust system there are numerous smaller exhaust fans each serving an individual room which then discharge into a filter plenum and then into the main building exhaust fans. Special precautions must be taken when any maintenance or filter change operation is to be performed on the exhaust system between the individual exhaust fans and the inlet side of the HEPA filter stage as a positive pressure could exist in the system. There are a number of exhaust fans that are not in use at this time and in some cases the hood or process has been removed but the fan and duct work is still in place. The Building 991 Complex exhaust systems and their status is detailed in Table 2-2 and in Figures 2-16 and 2-17.

Exhaust fans E-2, E-3, E-4, E-8, E-15, E-18, E-20, E-23, E-24, and E-25 discharge into the main exhaust plenum located on the roof of Building 991. The exhaust air passes through a fire screen (demister) and a single stage of HEPA filters. Heat sensors are located in the inlet ducts which will alarm at the Fire Department and initiate the plenum deluge automatic sprinkler system (reference discussion in Section 2.3.1.4).

Table 2-2 Building 991 Complex Exhaust Systems

Exhaust System	Status
E-1	System not in use.
E-2	System located on the roof of Building 991 and serves the north side of the building with grills in the hallway and hoods (removed) in Room 157. S-1, E-20, E-4, and P-2 will stop if E-2 is stopped. System not in use.
E-3	System located on the south wall of Room 130 and serves the women's restroom and shower area. E-3 is interlocked with S-3 in that S-3 will stop if E-3 is stopped.
E-4	System is located on the ceiling of Room 132 and serves Room 132 and the men's restroom and shower area. If E-4 is stopped, S-1, E-20, E-18, and P-2 will stop.
E-8	Exhaust fan is located on the roof of Building 991 and serves Room 101. It is interlocked with S-4 and starts when S-4 is started. This fan not in service currently.
E-11	System not in use.
E-12	System not in use.
E-14	System not in use. There are two fans labeled E-14. One is located on the roof of Building 991 (fan recently labeled as disabled). The other is located in hallway 149.
E-15	System is located on the roof of Building 991 and serves the radiography area, Rooms 160 through 165. E-15 is user controlled and is normally run when film processing is taking place.
E-16	System not in use.
E-18	System is located on the roof of Building 991 and serves Building 998 (Room 300 and Corridor A). This system has a single stage plenum on the roof of Building 991 by the fan to provide this system with an additional stage of filtration. The additional stage is not tested. S-1, E-20, and P-2 will stop if E-18 is stopped.
E-20	System is located on the roof of Building 991 and serves a hood (hood is out of service and abandoned in place) in Room 140. E-4, E-18, and P-2 will stop if E-20 is stopped. This fan is not in service currently.
E-22	System not in use.
E-23	System located on roof of Building 991 and exhausts Room 150.
E-24	System is located on the roof of Building 991 and serves Room 155. S-2 will stop if E-24 is stopped
E-25	System located on the roof of Building 991 and serves Room 143.
Plenum Exhaust Fans #1, #2, and #3	Systems located on the roof of Building 991 north of the main exhaust plenum with grills located in the north east-west running hallway. All supply and exhaust fans in Building 991 will stop if all plenum exhaust fans are stopped.
Plenum Exhaust Fan 601 (A and B)	System located in Building 985 and serves Buildings 996, 997, and 999 (vaults and corridors).

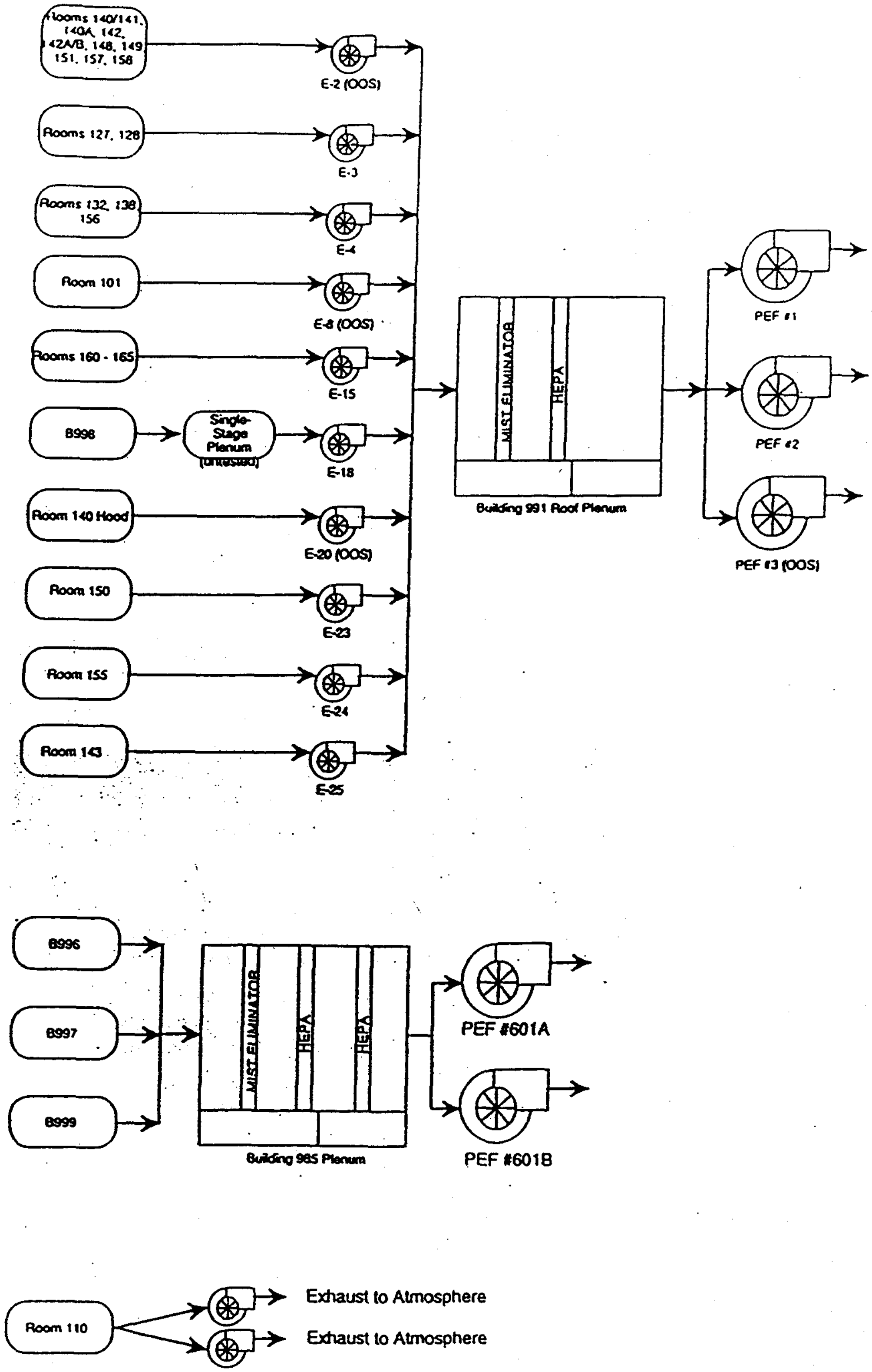

Figure 2-16 Building 991 Complex HVAC Exhaust System Simplified Flow Diagram

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PERSONNEL WITH ACCESS TO
UNCLASSIFIED CONTROLLED
NUCLEAR INFORMATION (UCNI)
MAY OBTAIN THIS INFORMATION
FROM THE
BUILDING 991 CLUSTER
CLOSURE PROJECT MANAGER

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Plenum exhaust fans (PEF) #1, #2 and #3 are located on the Building 991 roof north of the main exhaust plenum. The operating fan inlet vanes are controlled by a static pressure controller on the east end of the plenum. This gage was recently replaced so that the differential pressure across the HEPAs could be measure.. Only one PEF is required to provide the capability to exhaust Building 991. The automatic mode for the PEFs is considered out of service, therefore, the PEFs are operated in the manual mode configuration. Due to this configuration the operating PEF is checked once per working shift for proper operation by verifying the pressure differential in the Building 991 exhaust ventilation system with respect to atmosphere. The PEFs discharge into a common duct with air flow pitot tubes and air sampling connections. The exhaust air is then discharged to the atmosphere through a duct at the northwest corner of Building 991. All supply and exhaust fans in Building 991 will stop if all PEFs are stopped.

Exhaust plenum 601 is located in Building 985 and serves Buildings 996, 997 and 999 (vaults and tunnels). Like the Building 991 roof plenum, the Building 985 inlet ducts to the plenum have overheat sensors that alarm at the Fire Department and will initiate the plenum automatic fire sprinkler system (reference Section 2.3.1.4). This plenum consists of an inlet demister followed by two stages of HEPA filters. Pressure drop indication for each stage is provided on a panel at the west side of the plenum. The exhaust fans are located at the west end of the plenum, one in operation and one in standby. A static pressure controller for each fan is located in Room 402 that will modulate the inlet damper to maintain a set point of 0.8 inches w.g. The Building 985 plenum fans discharge through a back draft damper that opens when the fan is started. The discharge duct to atmosphere contains Health Physics air sampling connections. The plenum exhaust fans are connected to the diesel generator power in the event of loss of normal power.

In addition to plenum exhaust systems located on the roof of Building 991 and in Building 985, there are two small exhaust systems located on the roof above Room 110. These exhaust systems are user controlled and are discharged directly to the atmosphere without going to the building exhaust system. Metallography laboratory operations in Room 110 have been curtailed so these systems are not normally in use. These exhaust systems were recently disabled to prevent a possible flow imbalance in the waste storage areas if the systems were used.

The Building 991 exhaust system is most effective in the north portion of the building (i.e., areas north of the wall separating Rooms 134 and 140/141. The north areas are exhausted by exhaust ducts located on the hallway walls; by exhaust ducts located in Room 140A, Room 156, Room 142; Room 143, Room 150, and Room 155. These exhaust systems generally feed into the exhaust system that feeds into the Building 991 roof plenum. The exhaust duct in Room 142 may not feed into the plenum exhaust system. This exhaust, if through exhaust system E-14, discharges the air directly into the atmosphere (this exhaust system is electrically isolated).

Building 998 (Room 300 and Corridor A) is a working exhaust system which discharges the air directly into the Building 991 roof plenum exhaust system. The Building 998 exhaust system contains an untested HEPA stage on the roof where the exhaust fan is located. Building 998 is exhausted by exhaust system E-18.

Buildings 996, 997 and 999 and Corridors B and C are exhausted by the Building 985 filter plenum. This system also draws some air from the north side of Building 991. If this system is inoperable, it is expected that air from these buildings and corridors would be exhausted by the Building 991 plenum exhaust fans. The door located in Corridor B would probably have to be left open to obtain an adequate flow from the buildings.

Room 134 has no dedicated filtration system. Depending on the configuration of the building (e.g., roll-up doors between Rooms 170 and 134 and Rooms 170 and 140/141 left open; supply system S-1 in Room 130 door left open; installation of fire doors between the office area and Room 134, etc.) air may either exhaust into or out of the room. Possible exhaust paths for the air in Room 134 are through an exhaust duct located in Room 132 (exhaust system E-4) and one located in Room 135 (probably exhaust system E-20). The airlock doors in the north-south running hallway have been removed, which ensures a dedicated flow path for Room 134 into the north portion of the building no matter the configuration of the roll-up doors. Therefore, air in Room 134 is expected to be exhausted by the Building 991 exhaust filtration system.

Room 170, the west dock, has no dedicated filtration system. Good air flow was noted from Room 170 into Rooms 140/141 through the fire doors. The future modification plans of the building include installing a fire-rated roll-up door between these rooms with smoke detectors. The plan is to keep this door normally open but this cannot be guaranteed. If the door remains open, and if the Building 991 roof plenum exhaust fans are operating, air from Room 170 could be exhausted through the north building exhaust ducts. If the door is closed, either intentionally or because the heat detectors automatically close the door, and if other flow paths to the north portion of the building are blocked, the air probably will not be exhausted through a HEPA filtration system.

Room 166 has no dedicated filtration system. Air in this room does not exhaust through a HEPA filtration system.

The office area, Rooms 101 through 129, have no dedicated filtration systems except for the exhaust fan for the women's bathroom and locker room. This exhaust system feeds the Building 991 roof plenum exhaust system. An exhaust system (E-8) is located in Room 101 but the system is not operational. This exhaust system also feeds the Building 991 roof plenum exhaust system. During the summer months, operation of the return air fan does function to exhaust portions of the office area. This system exhausts directly to the atmosphere. Two other exhaust systems are located in Room 110. These systems, when operational, exhaust directly to the atmosphere.

An engineering evaluation (Ref. 26) concluded that the south waste storage areas (Rooms 134, 147 and 170) should be considered HEPA filtered and that Room 166 should be considered an unfiltered area. This evaluation recommended that a permanent differential pressure gage be located in Room 170 to measure the differential pressure in this room with respect to an atmospheric reference. The evaluation also recommended that exhaust fan E-14 and the Room 110 exhaust fans be permanently disconnected to preclude any potential disruption in the existing flow paths. These recommendations have been incorporated along with installation of two additional differential pressure gages with the Room 170 differential pressure gage. The second differential pressure gage is being installed to measure differential pressure between the inlet portion of the plenum and an atmospheric reference. This measurement provides an indication that a main plenum exhaust fan is running. A third differential pressure gage is being installed to measure the differential pressure across the Building 991 ventilation system exhaust plenum. This measurement provides an indication that the plenum single stage of HEPA filtration is unblocked.

Certain facility configurations have been identified that do not yield desirable negative pressure in Room 147 and 170. This situation results when (1) the Room 170 dock doors are opened (assumed to result in insufficient negative pressure even with the expected inflow of air); and (2) the Room 170 doors to Rooms 149, 140/141, and 134 are all closed (Room 170 isolated from Building 991 exhaust ventilation system).

In conclusion, as long as the proper facility configuration is maintained, it is expected that all waste storage areas of the facility will be exhausted by the Building 991 roof plenum with the exception of Room 166.

2.3.2.3 HVAC Heating System

All the Building 991 Complex heating systems are supplied from natural gas fueled boilers located east of Room 166 of Building 991. The natural gas fueled boilers have replaced the steam system that previously supplied heat to the building. This change was necessary since the underground section of the steam system had developed leaks over the years and has deteriorated. Complete failure of the steam system would have left the Building 991 Complex without any heating capacity.

Two Rite Model 300LNX weatherproof, inclined water tube forced draft boiler/burner units are located approximately 15 feet east of Room 166. The boiler construction consists of the boilers, the burners, the control panel, and the gas train. The boilers are constructed to meet the American Society of Mechanical Engineers (ASME) Boiler Code No. IV for 125 psi W.W.P UL/CSD-1/FM Code. They are custom designed for outside operation. The boiler construction consists of 2 inch outside diameter inclined boiler tubes rolled and flared into 5/8 inch thick tube sheet. These boiler tubes are ASME rated at 125 psi. The outside body of the boiler is insulated 18 gauge, galvanized metal jacket with an enamel paint finish. The boiler has a built in combustion chamber with 2,750°F high temperature castable refractory and 3 inches of insulation. The boilers are approved to handle 2,500 cubic feet (ft^3)/hour supplied natural gas. The normal operating pressure of the boilers is 30 psi and the boilers have an ASME pressure relief valve that is set at 45 psi. Included as part of the boilers is a McDonnell-Miller TC-4 low water cutoff with test and check valve and a McDonnell-Miller #63 auxiliary low water cutoff with manual reset. A Honeywell high limit safety control with manual reset is also installed.

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The burners are Model LNR 8.4-G-20 high altitude Gordon Piatt low emission, low NO_x, Underwriter's Laboratory (UL) listed, forced draft full modulating gas burners. Natural gas is supplied to the burners of the units at 2 psi from a two-inch natural gas line located next to the outside wall of Room 166 and the burners can burn 830 British Thermal Unit (BTU)/ft^3/hour. The forced draft fan of the burners is a 2 hp fan that operates at 460/60/3∅ volt with a motor speed of 3,450 revolutions per minute (rpm). An air flow safety switch is installed to shut down the burners if required. The burners also have a 6,000 V ignition transformer.

The control panel for the boiler system is located on the units with a dust tight door with a locking latch. The control panel includes a programming combustion relay; control circuit on/off switch and fuse; control voltage step down transformer; manual/auto potentiometer and switch, and a magnetic starter.

The gas train is UL/CSD-1/FM approved and is capable of handling 830 BTU/ft^3 natural gas supplied at 2 psi. The gas train includes a manual gas cock, a gas pressure regulator, a main gas valve and motorized safety gas valve, a leak test valve, a butterfly modulating gas valve, and low and high pressure switches.

Hot water lines from the boilers are routed above the roof of Room 166, through the wall of Room 137, and connected with the existing hot water supply and return system. As part of this installation a circulating pump was installed in Room 137. This 5 hp circulating pump has a capacity of 400 gpm and operates at 460 V/3∅. This modification also included removing portions of the steam and condensate lines from inside Room 137 out to above ground steam lines located north of Room 166.

Table 2-3 describes the existing pumps that are part of the heating system for the Building 991 Complex.

Table 2-3 Building 991 Complex HVAC Heating System

Pump	Configuration
P-1	The baseboard heating pump. This pump supplies the wall radiators along the outside wall in the south side of Building 991 for Rooms 101 through 122. A pneumatic controller on the east wall of Room 130 operates a marcoid switch to start P-1 when the outside air temperature drops below 60°F.
P-2	This pump supplies the reheat coil in the S-1 hot deck. The pump is manually started and is normally turned off during the summer months. Pump P-2 is interlocked with the S-1 fan and will stop if the S-1 fan is turned off.
P-3	This pump supplies the heating water to the radiography area. A thermostat in Room 160 starts P-3 when the room temperature drops below the designated setting.
P-4	This pump supplies the overhead space heaters in Room 166. The circulating fans are controlled by room thermostats located in the area. P-4 is manually controlled and is normally turned off during the summer months.
P-5	This pump supplies all reheat coils throughout Building 991. P-5 is manually controlled and is normally turned off during the summer months.
P-6	This pump supplies the overhead space heaters in the west loading dock area. The space heater circulating fans are controlled by thermostats in the area. P-6 is manually controlled and is normally turned off during the summer months.

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Pump	Configuration
P-7	This pump supplies the preheat coils on S-1, S-2, S-3, S-4 and S-5. P-7 is controlled by an outside air sensor (T-21) located on the north wall of Room 137. T-21 will start P-7 at an outside temperature of less than 70°F.

Due to the many alterations to Building 991 over the years there is duplication in equipment numbering. The pumps numbered P-1 through P-7, as discussed above, are all located in Room 137 along the south and west walls. The preheat coil pumps, numbers P-1 through P-5 and discussed in Section 2.3.2.1, are all located by their respective supply plenums.

On loss of normal power, pumps P-5 and P-7 in Room 137, can be supplied with power from the Building 989 diesel generator. An interruption of power will cause the starters for these pumps to open and the start buttons will have to be pressed to restart the pumps. The pumps should provide enough circulation to prevent freezing during power outages during freezing weather.

2.3.2.4 HVAC Chilled Water System

A multiple compressor unit located in Room 130 supplies chilled water to the S-3 system. A cooling water sump and circulating pump, located in Room 130, provide condensing water and a chilled water pump, located by the unit, circulated chilled water through the chiller and to the S-3 plenum and to the coil units in the south end of the building. Chilled water pump P-8 circulates water through a three-way valve and the coil in S-3 plenum for cooling. A pneumatic controller in the S-3 control cabinet modulates the three-way valve to maintain fan discharge of 55°F.

Chilled water is supplied to the fan coil units located in Rooms 101 through 122. Each unit has a multiple speed fan with a control by the unit. By varying the speed of the fan the desired level of cooling for the space is attained. The room thermostats in this area do not control anything in this system. A chilled water controller in the control cabinet operates the compressors to maintain a chilled water temperature of 45°F. The system is manually operated and is started as required during the spring, summer and fall months.

2.3.3 Life Safety/Disaster Warning System

The Building 991 Complex Life Safety/Disaster Warning (LS/DW) System provides annunciation to building workers for emergency response actions and general building announcements. The LS/DW system is a multiple-input, Site-wide, public address system. The LS/DW system in the Building 991 Complex is used to make emergency announcements and to alert personnel of hazardous situations, such as airborne contamination, fires, emergency response activities, or impending natural disasters. The microphone input is located close to the building entrance in Room 113. Continuously playing music and Site-wide announcements are generated from the CAS in Building 121. The CAS dispatcher can selectively communicate with individual buildings or the entire Site via an intercom system.

LS/DW speakers are located throughout the Building 991 Complex. A building amplification system drives the individual speaker-dedicated amplifiers. The LS/DW panel is located in Room 129. There are locations within Building 991 where the LS/DW system cannot be heard. These areas are posted.

2.3.4 Compressed Air System

Compressed air is required for the dry-pipe suppression systems located in the Building 991 Complex. These areas are the East Dock, Building 989, the West Dock (Room 170), and the west canopy area. Compressed air is supplied to these systems by either a compressor in Building 991 (Room 130) or the compressor located in Building 985. Either compressor has the capacity to supply the load required by the dry-pipe suppression systems.

The compressor located in Room 130 is normally operated in the manual position and the control on the air receiver will load the compressor at 80 psi and unload at it at 90 psi. Cooling water to the after cooler and the compressor is from the DCW system through a backflow preventer located on the south wall of Room 130 under the after cooler. This water flow is adjusted to not use excessive water but supply enough cooling. This cooling water flow must be checked on each tour of the building.

The second compressor, located in Building 985, will start if air pressure falls to 65 psi and will supply both dry-pipe suppression systems. This unit will cycle off at 80 psi. Building 985's air compressor capacity is large enough to supply the dry-pipe suppression systems for short periods of time, but should not be operated for extended periods without cutting back on air usage. On loss of normal power, the Building 985 compressor is supplied power from the Building 989 diesel generator.

The air system is in operation continuously and the operating compressor is checked daily for proper operation.

2.3.5 Utility Systems

2.3.5.1 Electrical Services

Electrical power is supplied to the Site by Public Service Company (PSC) of Colorado. Three main feeds from the PSC transmission grid supply electrical power at 115 kilovolt (kV). Parallel transmission lines from Ralston and Eldorado enter the Site from the east, north of the Industrial Area. A third feed, from the United Power Plainview, enters the Site from the west, south of the Industrial Area. Each of the feeds can be switched to supply the entire Site by themselves. The Ralston and Eldorado feeds have automatic switching capability while the Plainview feed has to be manually switched. The electrical power system on site consists of substations and secondary substations; the main switchgear; the ring bus switchyard; the overhead and underground electrical distribution lines, buses, support components, and outdoor lighting; and staff offices and maintenance facilities. All 115 kilovolt (kV) distribution is the responsibility of PSC. Site personnel assume the operating responsibility at the 115/13.8 kV substations. Substation 679/680 is the main substation for the Site.

The Building 991 Complex is served by two transformers that step the voltage down from 13.8 kV (received from Site substations) to 480 volts (V) normal power. The transformers, identified as 991-1 and 991-2 are located east of Room 166 of Building 991. Each transformer is sized to carry the load assigned to both. If power to one transformer is lost, the alternate automatically picks up and continuously carries the entire load. Switchgear inside Building 991 receives the 480 V power from the two transformers and distributes the power to power panels, motor control centers (MCCs), bus ducts, and emergency motor control centers (EMCCs). The power panels, MCCs, bus ducts, and EMCCs distribute the 480 V power to the larger normal power loads. The power panels, MCCs and EMCCs are located in Room 130 for the Building 991 loads. There is also a MCC and EMCC located in Building 985 that supply power to such items as the instrument air compressor and plenum exhaust fans in the Building. Smaller loads and 120 V loads receive their power from lighting panels and standard receptacles.

A panel in Room 130 of Building 991 is used to provide power to other buildings within the PA. This panel is provided power from the transformers 991-1 and 991-2 located outside Building 991.

Building 989 houses the diesel generator that supports equipment in the Building 991 Complex. The diesel generator provides an alternate, temporary source of 480 V power to the loads connected to the EMCCs. Loads that are on the diesel generator are identified in Table 2-4 (Ref. 27, 28, 29).

Automatic control circuitry, sensing loss of normal power, will start the diesel engine which starts the diesel generator. When the diesel generator reaches its rated speed and voltage, the transfer of the loads to generator power is accomplished by automatic transfer switches. One automatic transfer switch is located in near EMCC1E-9 in Room 130 to control the transfer of power for loads on EMCC1E-9. The second automatic transfer switch is located in Building 985 and controls the transfer of power for loads on EMCC1A-3 and EMCC1D-4.

The diesel generator has a rated output of 312 kilovolt amp (kVA) (256 kW) at 480 V, 3 phase, 60 hertz (Hz). The diesel engine has an output of 415 horsepower (hp) at 1800 rpm. A battery powered electric starter is used to start the diesel engine.

The control panel for the diesel generator is along the north wall of Building 989. It contains controls and indicators for the generated current, voltage, frequency, engine water and oil temperature, and oil pressure. Indicators for hazardous conditions, such as low oil pressure, overcrank condition, high water temperature, and overspeed, are also on the control panel.

An electric heater maintains the diesel engine water at approximately 120°F during non-operation periods to enable rapid and dependable starting.

A 180-gallon day tank and a 1000-gallon above ground tank supply the diesel generator with fuel. A pump is used to keep the 180-gallon day tank supplied with fuel at all times.

2.3.5.2 Steam and Condensate System

The steam and condensate system is no longer operable in Building 991. The function has been replace by weatherproof boilers located outside Building 991, Room 166. The steam and condensate lines were removed from inside Room 137 of Building 991 out to the northeast corner of Building 991.

2.3.5.3 Sanitary Process Waste Systems

All sanitary drains leave the building at the east side and into a manhole located by the northeast corner of Room 166. The basement tunnel floor drains are connected to a lift station at the southeast corner of the basement and two pumps, each controlled by a float switch, discharge into the sanitary drain line leaving the building. The Building 991 sewer line connects to the main sewer line at a manhole northeast of Building 991 just inside the PA.

There are process waste tanks located outside the south wall of Building 991 by Room 110 that are used to collect process waste from Room 110 and spray down water from the hood exhaust ducts. The tanks have high level alarms and are normally operated by metallography laboratory personnel. These process waste tanks are currently out of service and no hazardous materials are generated in the metallography laboratory.

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Table 2-4 Loads on Diesel Generator

EMCC	Load
EMCC1A-3	Lighting Transformer, 30 kVA, 480 V-120/208 V
	Breathing Air Receptacle
	Welding Receptacle
	Instrument Air Compressor
	Vacuum Pump P601B
	Pit Sump Pump P601
	Transfer Pump P602
	Vacuum Pump P601A & P601B
	Building 985 Supply Fan F602
	Plenum Exhaust Fan F601A
	Plenum Exhaust Fan F601B
	Health Physics Air Samplers
EMCC1D-4	Lighting transformer, 30 kVA 480V-120/208V
	Breathing Air Receptacle
	Welding Receptacle
	Instrument Air Compressor, AC-601
	Pit Sump Pump P601
	Transfer Pump P602
	Vacuum Pump P601A & P601B West
	Hot Water Circulation Pump, P604A West
	Hot Water Circulation Pump, P604B East
	Building 985 Supply Fan, F602
	Plenum Exhaust Fan F601A
	Plenum Exhaust Fan F601B
	Health Physics Vacuum Pump A
	Health Physics Vacuum Pump B
EMCC1E-9	Vacuum Pump
	Plenum Exhaust Fan #1
	Plenum Exhaust Fan #2
	Plenum Exhaust Fan #3
	15 kVA Panel
	25 kVA Panel
	Generator Building 989
	Air Sampling System
	Circulating Pump P-5

A fire water holding tank is located in a pit at the east end of Building 985. The tank is designed to collect the drains from the exhaust plenum in the event the plenum fire sprinklers are activated. If water is introduced into this tank, Waste Management is contacted for assistance in the disposal of the water. The system has a recirculating system for sampling the water and a pump that discharges to a hose connection by the east door of the building. By utilizing the pump and hose connection the contents could be transferred to a mobile tank by hose and transported to a disposal site. The fire water holding tank does not contain Raschig rings. In addition to the plenum drains, a sump pump in the fire water holding tank also discharges to the tank.

2.3.5.4 Domestic Process Water Systems

Domestic water for the building enters the southeast corner of the basement from a PIV located just west of the security fence. In the basement, domestic waste passes through a pressure reducing valve set at 60 psi and a totalizing meter for recording flow. Fire main water also enters the building at the same location and there are hose connections on both systems. In an emergency, due to a shutdown of either system external to the building, the systems could be cross connected by fire hose.

The domestic water main runs the length of the utility tunnel and all the supplies to the various usage's tap from this main. The domestic hot water system is fed from the main at the bottom of the stairway from Room 130 and is piped to the domestic hot water heat exchanger located in Room 137.

2.3.5.5 Cooling Water Systems

The S-1 cooling tower is located in Room 130 and provides the cooling for the S-1 air conditioning compressor. A fan located on the top of the tower draws air through a set of dampers controlled by a controller on the refrigerant line to maintain 110 to 120 psi. A spray pump draws water from the tower sump and sprays it into the air stream of the tower and over the condenser coil. The sump level is maintained by a float valve that adds water through a backflow preventer at the south end of Room 130. The cooling system is manually started and is normally operated during day shift as required during the spring and fall months. During the summer months the system operates continuously.

The S-3 cooling tower is located on the roof and the sump is located in Room 130. The cooling water pump draws water from the sump and discharges through the S-3 air conditioning condensers. The outlet from the condensers is then sprayed into the top of the cooling tower. A temperature sensor in Room 130 and sump that will start the fan at 70°F and stop it at 60°F control the fan. The cooled water drains from the tower back to Room 130 sump. A float valve in the sump adds make-up water through a backflow preventer located on the south wall of Room 130. This system is manually operated and is normally operated for day shift during the spring and fall as required. The system operates continuously during the summer months.

2.3.6 Lightning Protection System

A lightning protection system is installed on the Building 991 Complex, specifically Buildings 991 and 985. The lightning protection systems consist of air terminals uniformly spaced along the periphery of the roofs, across open roof areas, and on equipment on the roofs especially susceptible to lightning strikes. All air terminals are electrically interconnected to the grounding system via connected grounding conductors.

The surrounding terrain provides some degree of shielding from lightning strikes. This shielding is a result of the roof line of Building 991 being within a few feet of local grade level. Building 989, because of its low profile close to Building 991 and the surrounding structures, is effectively shielded and does not require a lightning protection system. Lightning protection for the Buildings 996, 997, 998 and 999 is not required since these structures are underground.

2.3.7 Building Drain System

Drains are located on the roof of Building 991 to drain water from the roof. The drains flow directly into the sanitary waste system.

Sanitary drains are located throughout Building 991 and drain directly into the sanitary waste system as discussed in Section 2.3.5.3.

2.3.7.1 Filter Plenum Drain Systems

The Building 985 plenum is supplied with a fire water holding tank to catch water from operation of the plenum deluge system. The fire water holding tank is located in a pit at the east end of Building 985. The tank is designed to collect the drains from the exhaust plenum in the event the plenum fire sprinklers are activated. If water is introduced into this tank, Waste Management is contacted for assistance in the disposal of the water. The system has a recirculating system for sampling the water and a pump that discharges to a hose connection by the east door of the building. By utilizing the pump and hose connection the contents could be transferred to a mobile tank by hose and transported to a disposal site. The fire water holding tank does not contain Raschig rings. In addition to the plenum drains, a sump pump in the fire water holding tank also discharges to the tank.

The Building 991 roof plenum has no fire water holding tank. Water from the plenum deluge system drains from a drain located in the plenum directly into the sanitary waste system.

2.3.8 Confinement Systems

The primary means of confinement in the Building 991 Complex are the shipping packages. The secondary means of confinement is provided by the concrete construction of the Building 991 Complex. Since operations with unconfined materials are not allowed in the Building 991 Complex (i.e., waste containers are not opened in the complex), other confinement systems are not required.

Currently, material being moved or stored in the Building 991 Complex is in approved on-site or off-site shipping packages. TRU waste, received from the PA, is packaged in 55 gallon drums, DOT-7A Type A Metal Waste Boxes, or Transuranic Package Transporter II (TRUPACT II) Standard Waste Boxes (SWBs).

One type of 55-gallon drum received and stored by the facility is the pipe overpack container (POC). The POC was designed to optimize shipments of high plutonium content TRU waste from Rocky Flats Environmental Technology Site (RFETS) to the Waste Isolation Pilot Plant (WIPP). The container was approved for use in the TRUPACT II shipping container by the Nuclear Regulatory Commission in February 1997. The POC consists of a sealed pipe component (Schedule 40 pipe with 6-inch diameter or Schedule 20 pipe with 12-inch diameter), contained within a Type 17C 55-gallon drum. The pipe component is separated from the drum by fiberboard packing material and a plastic liner. The lids of both the drum and the pipe component have filtered vents. The POC qualifies as a Type A package because this drum does. Waste will not be placed directly into the pipes. Rather, the waste will be placed in secondary containers, which will then be placed in the pipes. The robustness of the POC was assessed based on data taken from reports of Type B protocol testing conducted at the Sandia National Laboratories (crush, drop, and fire tests), explosion tests, pressure tests, and Finite Element computer modeling of crushing and puncturing. The POC does not qualify as a Type B container because it was not subjected to the complete Type B protocol testing program. In the crush test, the 55-gallon drums suffered damage, but none of the pipe components were damaged. All of the pipes tested as leak-tight both before and after the crush tests. The drop tests conducted indicated that the pipe components by themselves, and the pipe components inside 55-gallon drums, remained leak tight following up to 30-foot drops. In the thermal test, three of the POCs were equipped with the polyethylene-housed filters and the fourth POC was equipped with the stainless-steel housing on the filter. For the three POCs with the polyethylene-housed filters, the pipe temperature never exceeded 200°F and the pipes suffered no discernible damage, and all three tested leak-tight following the fire. The fourth POC, the one with the stainless-steel housing on the filter, suffered damage. The leak test conducted after the fire test showed that this pipe did leak. Explosion tests were also performed on the pipe components. None of the explosions ruptured the pipe component or even caused it to leak. Pressure tests were performed on the POC which showed no leakage from the pipe components. Because no Type B protocol puncture testing was done on the POCs, Finite Element modeling was performed to simulate an accident involving the collision of a forklift tine with the POC and to simulate the falling of heavy objects onto the POC. This modeling indicated that the POCs could be susceptible to damage (involving a release of radioactive material) from either a puncture event or from a side impact from a heavy object. Therefore, accidents involving POCs do need to be considered in the safety analyses. (Ref. 30)

Off-site shipping packages containing Category I/II SNM are staged in the facility. These packages meet DOT requirements for certified Type B packaging (e.g., 30 foot drop test and 30 minute fire barrier). The off-site packages provide double containment (e.g., sealed can inside a drum). Some classified parts are stored in non—Type B containers. These parts have a low level of surface contamination that could not contribute to a radiological release in the event of a loss of power without other concurrent failures (Ref. 31).

A slight negative air pressure (not measured) is maintained between the building and the outside environment. Portions of Building 991 air is exhausted through a one-stage HEPA filter plenum located on the roof of the building as discussed in Section 2.3.2.2. A slight negative air pressure (not measured) is also maintained in the storage vault in Building 991, Room 150. Building 998 also has an untested single-stage HEPA-filtered exhaust system that empties into the Building 991 roof filter plenum.

2.4 REFERENCES

1 *Plan for Relocation of Building 991 SNM,* Revision 7, EG&G Rocky Flats Plant, November 13, 1992

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CHAPTER 3

SAFETY MANAGEMENT PROGRAMS

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3. SAFETY MANAGEMENT PROGRAMS

3.1 INTRODUCTION

Site Safety Management Programs (SMPs) provide for implementation of health and safety standards requirements applicable to the Rocky Flats Environmental Technology Site (Site). An assumption of the analysis in this authorization basis (AB) is that implementation of the SMPs provides specific safety functions that are either specifically credited or recognized to be important for providing defense-in-depth. These SMP safety functions and/or key attributes are identified in this chapter. Implementation of these requirements, tested for adequacy through assessments and experience feedback as discussed below, is judged sufficient to provide for the safe and effective conduct of Building 991 Complex activities. These safety functions and attributes guide determination of the significance of any SMP implementation issues. The Administrative Controls (ACs) contain additional programmatic elements and specific controls or restrictions specifically credited in the safety analysis. Compliance with the ACs is administered through the AB as described in the TSRs.

Program manuals for the various SMPs provide the mechanism to flow requirements from orders and regulations down to any contractor performing work at the Site. The program manuals are implemented at the facility and project level. The compliance status of facilities and projects is assured through internal and external assessments. Issues identified regarding SMP compliance are managed through an established integrated process.

Sections 3.1.1 and 3.1.2 describe the various assessment types used at the Site and the processes used to address deficiencies. Sections 3.2 through 3.18 describe the SMPs identified as important to the Building 991 Complex.

3.1.1 Assessments

Kaiser-Hill (KH) and the Principal Subcontractors (PSCs) operate in an oversight environment of continual evaluation that consists of external oversight and internal oversight. External oversight is provided through the performance of oversight activities by the Department of Energy-Rocky Flats Fields Office (DOE-RFFO) and those regulatory and enforcement organizations that are independent of the Site. Internal oversight is provided through the performance of oversight activities by KH and PSCs. Internal oversight consists of management assessment, independent assessment, program oversight, and performance oversight. Internal oversight activities are performed in compliance with the *Site Integrated Oversight Manual* (SIOM), 1-MAN-013-SIOM (Ref. 1).

Program oversight consists of the formal evaluations of Site infrastructure program areas. The SIOM contains a listing of areas where KH and the KH Site infrastructure program managers have chosen to extend their evaluations to include actual Site-wide implementation and assurance of compliance with established program area requirements and expectations. Performance oversight is performed by the KH operational Vice Presidents (VPs) responsible for

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the successful completion of a PSC's scope of work. These assessments are conducted as necessary and often take the form of readiness demonstrations or activity oversight.

Management assessments are also performed. The SIOM contains requirements for performing management assessments and the *Management Assessment Program* (MAP), procedure 3-W24-MA-002 (Ref. 2), establishes the method and processes for planning, scheduling, and performing management assessments by KH. PSCs may use the KH MAP procedure or develop their own that meets the requirements of the KH procedure. Issues identified through MAP assessments are recorded, tracked, trended, and corrected in accordance with the Site Corrective Action Process as discussed below.

Both internal and external assessments provide assurance that the SMPs are healthy at the building, project, and Site level with respect to implementation of programmatic requirements. Issues identified through assessments are managed as described below in Section 3.1.2, *Program Management*. Facility management is responsible for assuring issues identified during assessments are screened against this authorization basis (AB), if appropriate.

3.1.2 Program Management

Program owners are responsible for maintaining SMPs in compliance with DOE Orders contained in the KH contract. Issues identified regarding lack of compliance at the SMP level with DOE Order requirements are corrected or a formal exemption request is submitted Exemption requests will be screened through the Unreviewed Safety Question Determination (USQD) process to determine significance with respect to this AB.

Issues of non-compliances with Site programs are evaluated as issues through the Site *Corrective Action Process*, procedure 3-X31-CAP-001 (Ref. 3) and the *Plant Action Tracking System*, procedure 1-P04-PATS-16.00 (Ref. 4) or other Quality Program approved alternative deficiency and corrective action tracking systems as defined in the *Site Corrective Action Requirements Manual*, 1-MAN-012-SCARM (Ref. 5). This infrastructure provides for tracking and trending of individual non-compliances and evaluations of significance. Characterization information is identified for documented deficiencies. These data are recorded and tracked at the Site level since individual deficiencies may be assigned a low level of significance or risk but when viewed collectively they may be highly significant. Issues occurring in this facility and characterized as having high significance through the Corrective Action Process should be reviewed through the USQD process (Ref. 6) to determine impact on this AB.

The *Price-Anderson Amendments Acts (PAAA) Program Manual*, 1-MAN-022-PAAAPROG (Ref. 7) provides a consistent process for screening and reporting PAAA applicability for issues associated with nuclear facilities and activities. The PAAA is applicable to issues in nuclear facilities if there is a potential noncompliance with a Nuclear Safety Rule Requirement or if it can be shown that a process used in a nuclear facility is deficient and is the cause of the issue. The mechanisms for identifying items for the PAAA organization to evaluate include various assessment programs – both internal and external – and the occurrence reporting process. A screen is performed and significance of individual issues, as

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well as the collective significance of other related non-compliances, is determined. If the PAAA screen considers a programmatic deficiency to be a potential concern, the Condition of the program should also be reviewed against this AB to determine whether there is a potential for an Unreviewed Safety Question (USQ).

Data related to issues identified and reported through the Site Corrective Action Process or other approved alternative deficiency and corrective action tracking systems are analyzed and trending is performed in accordance with the *Data Analysis and Trending for Performance Improvement*, procedure 1-E93-ADM-16.18 (Ref. 8). High significance issues, and any other issues a responsible manager identifies, will have a formal cause analysis performed in accordance will the *Cause Analysis Requirements Manual*, MAN-062-CAUSE ANALYSIS (Ref. 9). The results of this analysis should include corrective actions that may require modifications to this AB. Any modifications to this AB will be managed in accordance with the *Nuclear Safety Manual*, 1-MAN-018-NSM (Ref. 10).

These programs and processes require DOE notification for significant individual issues and notification for cases where potential or confirmed programmatic deficiencies exist. Notification of DOE may occur through various channels depending on the program or process that was being followed when an issue was identified. If the issue is determined to have significance with respect to this AB, additional notification to DOE specifically identifying the AB issue is required as well.

3.2 INTEGRATED SAFETY MANAGEMENT

The Building 991 Complex implements Integrated Safety Management (ISM) by the systematic integration of safety and environmental standards/requirements into the work planning and execution processes. This systematic integration of safety and environmental considerations into all complex activities results in the successful accomplishment of the activities while protecting the workers, the public, and the environment. The SMPs described in this chapter provide the necessary programmatic infrastructure and formalized discipline to meet the primary goal of ISM - "DO WORK SAFELY". Complex management requires specific activities to ensure work is performed safely. These activities include definition of work scope, identifying and analyzing hazards; development and implementation of operational controls, performance of work or operation; and feedback and improvement.

Definition of any given scope of work is accomplished predominately through the Work Control and Maintenance programs. The engineering documentation defines the technical work scope for any given maintenance activity, and the Integrated Work Control Program (IWCP) work package or operating procedures define the specific planned work scope. Chapter 1 of this FSAR identifies the activities authorized for planning or performance in the Building 991 Complex.

The identification and analysis of hazards involved in a work scope primarily falls within the domain of the Safety and Industrial Hygiene; Radiation Protection; Nuclear Safety, Criticality Safety, Fire Protection, and Work Control programs. The IWCP process defines the

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hazards analysis approach to be used in planning a maintenance activity, including: hazard identification; walkdowns of area and system; and incorporation of worker safety hazards analysis using appropriately skilled safety professionals.

The development and implementation of operational controls are typically derived from the hazard analysis and transferred into work control documents. The IWCP process governs this function for maintenance and construction activities through the development of specific controls, such as radiological controls defined in a Radiation Work Permit. The IWCP process also specifies post-maintenance testing requirements, based on the technical input from engineering. Lastly, the process requires a formal Safety Evaluation Screen and independent safety review where appropriate. The controls for safe storage and the conduct of routine activities are defined in the Technical Safety Requirements (TSRs) used to support the performance of work.

The performance of work at the complex is normally controlled through the Work Control; Training; Configuration Management, Environmental Protection and Waste Management, Transportation, and Maintenance programs. Specific activities are scheduled on the Plan of the Day (POD), are preceded by a pre-evolution briefing, and are formally approved by the Shift Manager prior to performance. Only appropriately trained personnel are used to perform the activity. Depending on the type of activity, core team members and building support personnel may receive a pre-evolution briefing to include a predefined or practiced set of responses to upset conditions.

Finally, feedback and improvement from performance of work or an operation are elements of the Quality Assurance (including management assessment), and the Organization and Management program. IWCP work packages are formally closed out and reviewed by the Building Manager. Engineering documentation also receives formal close-out. In addition, the Shift Manager reviews all surveillances and logs to provide close oversight and feedback on a day-to-day basis. Occurrence Reports provide feedback (e.g., critiques) on conditions and lessons learned related to routine performance in the complex.

3.3 ORGANIZATION AND MANAGEMENT

The Site Integrating Management Contractor (IMC) (i.e., Kaiser-Hill) has overall responsibility for the operation of the Site in accordance with the Site integrating management contract with the Department of Energy (DOE). The current contract provides for the Site IMC to delegate the authority and responsibility to Principal Subcontractors. Rocky Mountain Remediation Services (RMRS), Limited Liability Corporation (L.L.C.), has overall authority and responsibility for operation of the Building 991 Complex. Operations conducted in the Building 991 Complex by other subcontractors are performed in accordance with the documented authorization basis as maintained by RMRS. RMRS management has assigned authority and responsibility for the operation of the Building 991 Complex to the Building 991 Facility Manager. Others in the chain of operational responsibility include the Waste Management Operations Manager, Solid Waste Operations Manager, and Building Manager as shown in Figure 3-1.

The Site IMC President is responsible for overall safe operation of the Site and ensures that organization and management personnel, training, programs and procedures, configuration control, reporting requirements, records retention, safety review and audit systems, and reporting of unplanned events and unusual occurrences are sufficient to achieve the DOE mission for the Site. Key responsibilities relative to nuclear facility safety include:

- Maintain safe operation of the Site in accordance with contractual and regulatory requirements.
- Obtain DOE authorization for restart of facility operations when required.
- Ensure that accountability and commensurate authority for TSR compliance are formally delegated.
- Maintain adequate Site fire fighting capability.
- Ensure Site SMP capability sufficient to support building operations.
- Maintain Site support systems necessary for facility operations (e.g., remote alarms, fire water) and ensure that facility management is notified in the event of the loss of these systems.
- Ensure identified corrective action to prevent recurrence of TSR Violations is implemented for Site organizations.

More direct responsibility and authority for facility operations is maintained by the Facility Manager. Key responsibilities of the Facility Manager relative to nuclear facility safety include:

- Ensure compliance with TSRs and corrective actions in the event of departure from the TSRs.
- Initiate measures to classify all unplanned and unusual events.
- Report TSR Violations, ensure satisfactory cause determination, and ensure corrective action is taken to prevent recurrence.
- Maintain records of TSR compliance in accordance with Site procedures for records retention.
- Identify and initiate revisions to the TSRs, when needed.
- Receive and disposition safety issues.
- Establish and implement a Lessons Learned program for the facility.
- Ensure that individuals designated to supervise activities are sufficiently trained and qualified to supervise the conduct of those activities in compliance with the controls provided within the TSRs.

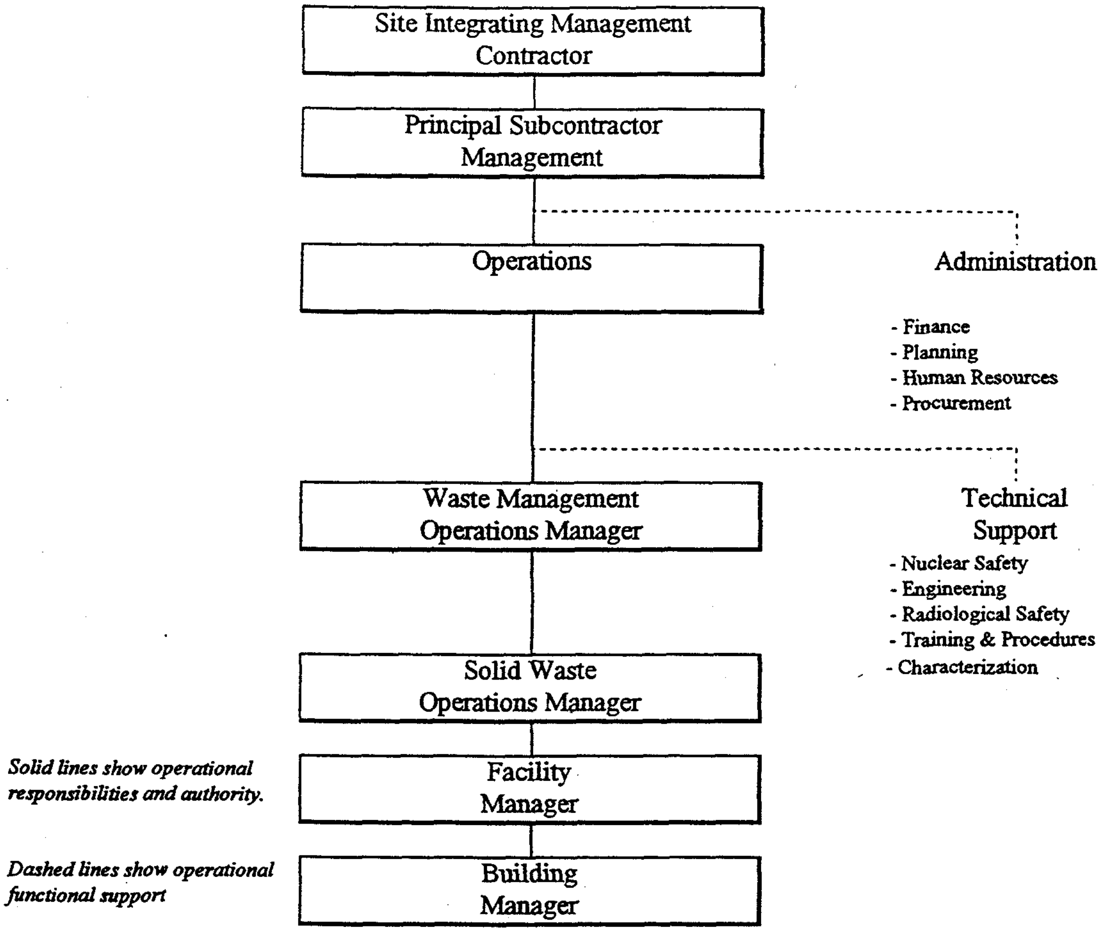

Figure 3-1 Building 991 Complex Line and Functional Responsibilities

The Building Manager provides command and control over daily operations. Key responsibilities of the Building Manager include:

- Determine if work can be safely conducted in the facility.
- Provide day-to-day authorization of work.
- Monitor the status of building systems and direct appropriate actions if upsets occur.
- Assume the role of incident commander until relieved.
- Review all surveillances and logs.

3.4 CONFIGURATION MANAGEMENT

The Configuration Management program integrates work control processes with required safety and technical reviews and technical document control to manage changes to safety structures, systems and components (SSCs) and non-safety SSCs that could impact safety SSCs. Implementation of Configuration Management protects the operability of engineered safety features and systems credited with prevention and/or mitigation of accidents. This is accomplished by ensuring the proper review, approval, and documentation of changes to safety SSCs and non-safety SSCs that could impact safety SSCs. The program stipulates that operation, maintenance, and modification of safety SSCs, and non-safety SSCs that could impact safety SSCs, rely on the development and use of properly authorized work plans, procedures and training. Further, the program ensures that such documents are properly maintained and controlled so that only appropriate revisions are implemented.

The Configuration Management program provides for an independent second engineering review for engineering documents, and authorization basis change packages and documentation potentially affecting safety analysis. Management review of authorization basis changes, complex changes and modifications, and other issues affecting the safety analysis is also provided. Management reviews of safety significant issues primarily focus responsible management attention on safety issues, such as unreviewed safety questions, criticality controls, modifications of equipment important to safety, and authorization basis modifications. These reviews ensure adequacy of work authorization and documentation affecting the safe operation of the Building 991 Complex.

Engineering supports configuration management through integration of fire protection, safety and industrial hygiene, nuclear safety and criticality safety, environmental protection and waste management, and radiation protection safety requirements into the development of new designs and design modifications, as appropriate. Engineering procedures ensure that changes or modifications within the Building 991 Complex are accomplished according to applicable codes, regulations, and standards. Each change that potentially affects a safety SSC receives review through the unreviewed safety question determination (USQD) process. The program maintains the authorization basis by providing for the control of documentation, review, and approval of proposed complex modifications and interfacing with other SMPs.

The Configuration Management program is implemented by the *Design Process Requirements* (Ref. 11) and *Site Design Document Control* (Ref. 12) procedures of the *Conduct of Engineering Manual* (Ref. 13).

3.5 CRITICALITY SAFETY

The Criticality Safety program for this building establishes criticality safety controls for building activities involving fissionable material. This program includes the following processes: to develop criticality safety controls (engineered and/or administrative); to monitor compliance status with established controls (including infraction investigation and reporting); and to maintain and control distribution of technical documents. The program ensures that Criticality Safety approves criticality safety controls, either through new evaluations or the Criticality Safety Limit Examination Program, for all activities involving the storage, relocation, and/or processing of fissionable material. Major features of the program include engineering design reviews; application of double-contingency principles; establishment of criticality safety controls (e.g., nuclear criticality safety limits, procedures, postings); testing; surveillances; training; and periodic program reviews.

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The Criticality Safety program is established by the *Nuclear Criticality Safety Manual* (Ref. 14) implemented via the DOE approved *RFETS Implementation Plan for the Nuclear Criticality Safety Manual* (Ref. 15).

No specific elements of the Criticality Safety program were identified as the program applies at all times in the Building 991 Complex. Criticality accidents have been determined to be incredible in the Building 991 Complex for the analyzed mission as long as an identified set of controls remains in place. This program supports AC 5.2 to ensure that the requirements are met and that the determination that criticalities are incredible remains valid.

One general assumption (transuranic (TRU) waste containers contain no more than 200 grams of fissionable material in drums) and two requirements (Type B and metal waste containers shall be designed and used in a manner to preclude a criticality as long as the containers remain intact) were utilized in the safety analysis to maintain the incredibility of a criticality accident in the Building 991 Complex.

3.6 EMERGENCY RESPONSE

The Emergency Response program provides the plans, procedures, and resources necessary to respond to emergencies. The program is based on a comprehensive understanding of the hazards and potential radiological and hazardous material release mechanisms present in the Complex. Emergency Response supplements and depends on engineered features and systems as well as the Fire Protection and Radiation Protection programs; collectively, these programs effectively minimize the occurrence of and mitigate accidents.

The program protects Building 991 Complex personnel through management planning; designation of an Emergency Response Organization; training and drills (Site-wide and Complex-specific) for possible abnormal events, including fires and spills; and personnel accountability during complex evacuation. During an abnormal event, the program provides the necessary trained emergency response personnel to aid in mitigation of the event to provide protection of the immediate worker, CW, and the MOI. Program elements of Emergency Response also include pre-planned actions, prompt and accurate emergency classifications, and timely notifications of the Emergency Response Organization.

The Emergency Response program is implemented by the *Rocky Flats Environmental Technology Site Emergency Plan* (Ref. 16) as augmented by the *Building 991 Emergency Response Operations* procedure (Ref. 17).

3.7 ENVIRONMENTAL PROTECTION AND WASTE MANAGEMENT

The Environmental Protection and Waste Management programs provide for managing radioactive and other hazardous waste material inventories, controlling building effluents, and managing waste generation (e.g., waste minimization), storage, treatment, and packaging. Waste management and environmental protection regulations establish the minimum standards for the discharge, generation, storage, or transportation of specified hazardous or toxic materials. These programs, in complying with the standards set by waste management and environmental protection regulations, reduce the risks of hazardous and radioactive material spills by ensuring appropriate packaging, inspection, and storage of those materials. These programs also aid in the detection of confinement degradation (drips and leaks) through routine surveillance/inspections. In addition, the programs assist with appropriate response planning and preparation for events such as hazardous material spills.

Requirements for the Environmental Protection and Waste Management programs are defined by the Colorado Code of Regulations 6 CCR 1007-3 (Ref. 18) and 5 CCR 1001-3, 4, 5, and 17 (Ref. 19), 40 CFR Part 148 (Ref. 20), and 40 CFR Parts 260-282 (Ref. 21), and implemented by the *Hazardous Waste Requirements Manual* (Ref. 22).

3.8 FIRE PROTECTION

The Fire Protection program provides fire protection engineering and hazards analysis, fire prevention requirements (control of combustibles, transient fire loads, hot work, and ignition sources; inspections; and training), and fire response. Fire response plans, training, and drills, as well as the inspection, testing, and maintenance of engineered fire protection and notification systems aid in the mitigation of the effects of a fire, fire fighting capability, and property loss minimization if a fire should occur.

The Fire Protection program is implemented by the relevant sections of the *Health and Safety Practices Manual* (Ref. 23), which includes the *Fire Protection Policy, Programs, Organization* (Section 30.00); *Fire and Life Safety* (Section 32.00); *Building and Facility* (Section 33.00); and *Fire Protection* (Section 34.00).

3.9 SAFETY AND INDUSTRIAL HYGIENE

The Safety and Industrial Hygiene program contains provisions to implement federal regulations addressing standard industrial hazards. Precedents for controlling standard industrial hazards are well established through institutionalized standards, guidelines, and good practices. Industrial Safety is generally implemented in concert with other SMP requirements.

The standards for the Safety and Industrial Hygiene program are 29 CFR Part 1910 (Ref. 24) and portions of 29 CFR Part 1926 (Ref. 25), and are implemented by the relevant procedures of the *Health and Safety Practices Manual* (Ref. 23) based upon the hazards of the work on an activity-by-activity basis and in MAN-072-OS&IHPM, *Occupational Safety and Industrial Hygiene Program Manual* (Ref. 26).

3.10 MAINTENANCE

Testing, surveillance, and maintenance is accomplished predominately within the Maintenance program, which ensures that safety SSCs perform their intended safety functions. Provisions of the Maintenance program specify that maintenance tasks be performed safely and within the Building 991 authorization basis. The program also integrates work control processes, including the identification, request, planning, implementation of maintenance, and testing, with engineering support and required safety and technical reviews. Maintenance of

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safety SSCs relies on the development and use of work plans that have been properly documented, reviewed, and approved. Testing is usually accomplished via surveillances prior to returning the SSCs to service.

Surveillances consisting of testing, calibration, and inspections are conducted to ensure that the operability of safety SSCs is maintained so that operations are within the specified TSRs. Surveillances are conducted in accordance with the TSRs. The performance of surveillances is typically conducted by the cognizant organization (e.g., Fire Department) for the safety SSC.

The Maintenance program is implemented by the *Integrated Work Control Program Manual* (Ref. 27) and the surveillance portion of the Maintenance program is implemented by the *Conduct of Operations Manual* (Ref. 28).

3.11 NUCLEAR SAFETY

The Nuclear Safety program provides safety evaluations, analyses, and reviews of building activities that potentially affect the health and safety of the public and/or workers or the protection of the environment. The program includes a process (USQD) for conducting safety evaluations of proposed activities, Building 991 Complex modifications, operational tests, and experiments. Additional provisions include the documentation, review, and approval of activity and complex-specific accident analyses. The Nuclear Safety program supports Configuration Management and is integrated with Maintenance; Training; and Work Control programs to identify and analyze the probability and consequences of potential nuclear and/or chemical accidents. Nuclear Safety further supports safe operations by conducting evaluations of the complex safety basis (e.g., USQD process) and ensuring appropriate approval authority and annual updating of the documented authorization basis.

Independent reviews and audits serve as a performance assurance function. By ensuring safety of operations and adequacy of work authorization and documentation affecting operation of the Building 991 Complex, independent reviews and audits provide defense-in-depth. The independent review and audit system is a hierarchical function. The upper most level is the Environmental Safety & Health (ES&H) Council whose members are drawn from senior management of the Site integrating contractor and subcontractors. The RMRS Waste Operations Review Committee, second level in-line independent engineering reviews, and other management reviews and assessments comprise additional tiers. The Committee considers nuclear safety issues, including physical changes to the complex, which could affect the safety envelope of the complex considering all receptors.

The Nuclear Safety program is implemented by the Site *Nuclear Safety Manual* (Ref. 10), the *Safety Evaluation Screen* process (Ref. 29), and the *Unreviewed Safety Question Determination* process (Ref. 6).

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3.12 OCCURRENCE REPORTING

The Occurrence Reporting program provides for the timely reporting of occurrences that could affect the safety of the public, seriously impact the intended purposes of the Site facilities, have an adverse affect on the environment, or endanger the health and safety of the workers. Actual and potential TSR Violations or TSR Out-Of-Tolerance conditions are reported to cognizant management and to the DOE. Provisions of the program specify the processes for occurrence categorization, notification, investigation, root cause analysis, development of corrective actions, tracking of corrective actions to completion, and lessons-learned determination.

The Occurrence Reporting program is implemented by the *Occurrence Reporting Process* (Ref. 30) procedure.

3.13 QUALITY ASSURANCE

The Quality Assurance (QA) program assures a consistent and appropriate application of quality requirements to the performance of activities using a graded approach. Safety, reliability, and performance are maximized through the application of effective management systems and graded controls commensurate with the risks posed by complex activities. Separate Quality Assurance Programs (QAPs) have been prepared that are similar in technical content, but differ in scope and applicability. One QAP is applicable to nuclear facilities activities with radiological risks and is subject to DOE enforcement. The other QAP is applicable to non-nuclear facilities and is a contractual obligation.

QAP requirements are management systems, which are implemented through existing Site procedures and programs. The purpose of these management systems is to assist organizations in the accomplishment of mission objectives; to ensure work is planned and performed in accordance with regulatory and contractual requirements; and to ensure complex activities are conducted in an efficient and effective manner. QA is a shared, interdisciplinary function. It involves management and immediate worker contributions from all organizations responsible for performing activities to independently verify that activities comply with specified standards and requirements. The QAP establishes ten criteria associated with management, performance, and assessment: program, personnel training and qualification, quality improvement, documents and records, work processes, design, procurement, inspection and acceptance testing, management assessment, and independent assessment.

An element of the QA program is the Management Assessment program. This program requires assessments be conducted to provide assurance to facility management of adequate implementation of SMPs and TSRs and to determine the effectiveness of those programs in support of facility operations. This program provides for early self-discovery and correction of performance problems.

The QA program is defined in the Rocky Mountain Remediation Services *Quality Assurance Program Description* (Ref. 31).

3.14 RADIATION PROTECTION

The Radiation Protection program implements standards, limits, and program requirements for protecting individuals from exposure to radioactive materials during the conduct of work activities. The program adheres to the fundamental principles of As Low As Reasonably Achievable (ALARA). The protection of personnel from radioactive materials is accomplished through radiological surveillance, contamination control, and minimization of personnel exposure to penetrating radiation. The program provides for personnel dosimetry, the surveillance and maintenance of engineered radiation protection systems, a radiation work permit process, and area surveillance and posting. Radiological protection for planned activities are ensured through reviews of work control documents, pre-job surveys, and the specification of personal protective equipment. Personnel exposures are formally tracked, recorded, and reported back to individuals. Exposure histories undergo periodic review.

Site standards for Radiation Protection are defined in 10 CFR Part 835 (Ref. 32) and are implemented by the *Radiation Protection Program* (Ref. 33) manual.

3.15 RECORDS MANAGEMENT AND DOCUMENT CONTROL

The Records Management and Document Control program addresses the criteria and processes necessary to control documents and retain records of activities affecting safety at the Site. The systematic approach to records management at the Site includes control, storage, retention, and disposal of records and documents. This program provides the processes for ensuring the use of appropriate and current documents for operations and maintenance. This program also ensures that the records of compliance are available to demonstrate the ongoing protection of the worker, the public, and the environment.

Records generated at the Site are controlled in accordance with the *Records Management Guidance for Records Sources* (Ref. 34). Documents are distributed and controlled in accordance with the *Document Control Program* (Ref. 35).

3.16 TRAINING

The Training program provides for the generation of accurate and consistent training of personnel to ensure the proper conduct of activities in the Building 991 Complex. This program provides the framework to ensure that personnel are knowledgeable of the hazards and capable of appropriate responses to upset conditions. A result of this program is that the appropriate collective knowledge of technical, safety, and operations professionals is transferred to the worker for the performance of activities.

Provisions of the Training program establish applicable training needs based on activities and associated hazards, operational experiences, and lessons learned. The Training program also establishes qualification standards graded to the safety significance of the job function, and establishes the documentation needed to assist complex operations in assigning adequately trained personnel to activities.

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The Training program is implemented by the *Training User's Manual* (Ref. 36) and the RMRS *Training Program Manual* (Ref. 37).

3.17 TRANSPORTATION

The Transportation program specifies safe packaging for on-site and off-site transportation of radioactive and hazardous materials to reduce the likelihood of a radioactive and hazardous material release and to reduce accident consequences. Facility management is ultimately responsible for the safe and compliant packaging of material that it releases for transport. The Transportation program describes a process for the incorporation of packaging requirements into work control documents, and defines training requirements for personnel involved in packaging and shipment of hazardous materials. Specific to the safe packaging of hazardous materials for off-site shipment, Department of Transportation (DOT) regulations contain the minimum standards for protecting workers, the public, and the environment from the inadvertent handling or impact-related release of containerized hazardous materials.

The Transportation program is implemented by the *Rocky Flats Transportation Safety Manual* (Ref. 38).

3.18 WORK CONTROL

The Work Control program encompasses the processes for conducting operations and the control of activities in the complex. The program provides an accurate, disciplined, and formal methodology for performing work and operating the facility. It promotes implementation of a set of standards that establish safe operations. Provisions of the program specify that all work is performed by appropriately trained personnel using adequate and controlled procedures; that work is properly supervised; that prior approval of all work is obtained; and that accountability exists for work performance. The program also provides processes for monitoring facility operations through functions such as log keeping, conduct of rounds, and internal surveillances Elements comprising this program, which are implemented through program procedures, include: conduct of operations, pre-evolution briefings, internal surveillance program, shift operating rounds, control of on-shift training, operations orders, safety SSCs operational status, independent verification, TSR tracking and documentation, communications criteria, operating area logs and records, plan of the day, controlled deactivation of alarms, control of Caution Tags, termination of operations process, and operability determination process.

Facility and Building Managers also use Work Control to plan and authorize existing and emergent activities for placement on the POD. Thus, Work Control is an integral part of daily operations and maintenance within the complex, and an effective tool for reducing the occurrence of accidents by ensuring that no unanalyzed or unauthorized work is performed Work Control provides a disciplined approach to defining and evaluating the hazards prior to the performance of new activities. To ensure safe performance, each emergent activity is defined and a graded hazard assessment is performed, as necessary, to establish appropriate procedure-level controls and to verify the adequacy of the complex-level control set established by this FSAR. To complete this verification, the results of the assessment are compared with the

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activities and hazard assessment analyzed in the FSAR and with the complex-level control set established by the FSAR. If the activity and its hazards are within the safety envelope as established by the FSAR, conduct of the activity is enveloped. If the activity is not enveloped, the USQD process is invoked.

The Work Control program is implemented by the *Conduct of Operations Manual* (Ref. 28).

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3.19 REFERENCES

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2 *Management Assessment Program*, **3-W24-MA-002**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, December 1, 1997.

3 *Corrective Action Process*, **3-X31-CAP-001**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, May 11, 1998.

4 *Plant Action Tracking System*, **1-P04-PATS-16.00**, Revision 2, Rocky Flats Environmental Technology Site, Golden, CO, October 1, 1997.

5 *Site Corrective Action Requirements Manual*, **1-MAN-012-SCARM**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, May 11, 1998.

6 *Unreviewed Safety Question Determination*, **1-C11-NSM-04.05**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, January 26, 1995.

7 *Price-Anderson Amendments Acts Program Manual*, **1-MAN-022-PAAAPROG**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, November 3, 1997.

8 *Data Analysis and Trending for Performance Improvement*, **1-E93-ADM-16.18**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, August 15, 1997.

9 *Cause Analysis Requirements Manual*, **MAN-062-CAUSE ANALYSIS**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, April 15, 1998.

10 *Nuclear Safety Manual*, **1-MAN-018-NSM**, Revision 0, Rocky Flats Environmental Technology Site, September 30, 1997.

11 *Design Process Requirements*, **1-V51-COEM-DES-210**, Conduct of Engineering Manual (COEM), Revision 2, Rocky Flats Environmental Technology Site, Golden, CO, November 25, 1997.

12 *Site Design Document Control*, **1-W56-COEM-AMN-101**, Conduct of Engineering Manual (COEM), Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, March 28, 1997.

13 *Conduct of Engineering Manual*, Revision 51, Rocky Flats Environmental Technology Site, Golden, CO, August 26, 1996.

14 *Nuclear Criticality Safety Manual*, **PADC-96-00095**, Revision 0, Kaiser-Hill, L.L.C., Golden, CO, February 26, 1996.

15 *RFETS Implementation Plan for the Nuclear Criticality Safety Manual*, Revision 2, Rocky Flats Environmental Technology Site, Golden, CO, December 2, 1996.

16 *Rocky Flats Environmental Technology Site Emergency Plan*, **EPLAN-97**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, February 28, 1997.

17 *Building 991 Emergency Response Operations*, **3-T76-BERO-14.991**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, August 25, 1997.

18 *Hazardous Waste*, **6 CCR 1007-3**, Colorado Department of Public Health and Environment - Waste Materials and Waste Management Division, Denver, CO. (Copies may be obtained from the Public Record Corp., 303-832-8262).

19 *Air Quality*, **5 CCR 1001-3, 4, 5, and 17**, Colorado Department of Public Health and Environment - Air Quality Control commission, Denver, CO. (Copies may be obtained from the Public Record Corp., 303-832-8262).

20 *Protection of the Environment*, **40 CFR Part 148**, Office of the Federal Register National Archives and Records Administration, Washington, DC

21 *Protection of the Environment*, **40 CFR Parts 260-282**, Office of the Federal Register National Archives and Records Administration, Washington, DC

22 *Hazardous Waste Requirements Manual*, **1-10000-HWR**, Revision 26, Rocky Flats Environmental Technology Site, Golden, CO, June 19, 1995.

23 *Health and Safety Practices Manual*, Rocky Flats Environmental Technology Site, Golden, CO, 1995.

24 *Occupational Safety and Health Administration, General Industry Standards*, **29 CFR Part 1910**, Office of the Federal Register National Archives and Records Administration, Washington, DC

25 *Occupational Safety and Health Administration, Construction Standards*, **29 CFR Part 1926**, Office of the Federal Register National Archives and Records Administration, Washington, DC

26 *Occupational Safety and Industrial Hygiene Program Manual*, **MAN-072-OS&IH PM**, Rocky Flats Environmental Technology Site, Golden, CO, September 30, 1998.

27 *Integrated Work Control Program Manual*, **MAN-071-IWCP,** Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, September 15, 1998.

28 *Conduct of Operations Manual*, **1-31000-COOP**, Rocky Flats Environmental Technology Site, Golden, CO, Current Revision.

29 *Safety Evaluation Screen*, **1-C10-NSM-04.03**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, April 11, 1995.

30 *Occurrence Reporting Process*, **1-D97-ADM-16.01**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, March 23, 1998.

31 *Quality Assurance Program Description (QAPD)*, **RMRS-QAPD-001**, Revision 1, Rocky Mountain Remediation Services, Golden, CO, January 1, 1997.

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35 *Document Control Program*, **1-77000-DC-001**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, November, 1993.

36 *Training User's Manual*, Rocky Flats Environmental Technology Site, Golden, CO, October 1, 1996.

37 *Training Program Manual*, **RF-RMRS-97-040**, Revision 0, Rocky Mountain Remediation Services, L.L.C., Golden, CO, August 28, 1997.

38 *Rocky Flats Transportation Safety Manual*, **PADC-94-01279**, Rocky Flats Environmental Technology Site, Golden, CO, December, 1995.

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CHAPTER 4

HAZARD AND ACCIDENT ANALYSIS SUMMARY

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4. HAZARD AND ACCIDENT ANALYSIS SUMMARY

This chapter provides a summary of the hazard evaluation and accident analysis performed for the Building 991 Complex. The hazard evaluation and accident analysis is documented in NSTR-011-98, *Safety Analysis for the Building 991 Complex Final Safety Analysis Report* (Ref. 1) and is considered an integral part of the authorization basis (AB) for the Building 991 Complex.

4.1 INTRODUCTION

Various hazards are currently present in the Building 991 Complex and are fully discussed in Reference 1. The most significant hazards with potential to impact public risk found in the Building 991 Complex are associated with radioactive materials in the form of Category I and II Special Nuclear Materials (SNM) and radioactive wastes. The Category I and II SNM is only found in Department of Transportation (DOT) approved, Type B shipping containers which are received by Building 991 and staged in the facility in preparation for off-site shipment. The radioactive waste materials are primarily stored in 55-gallon drums meeting on-site shipping specifications and/or DOT specifications; however, the facility may receive and store Transuranic Package Transporter II (TRUPACT II) Standard Waste Boxes (SWBs) and DOT-7A, Type A Metal Waste Boxes. The 55-gallon waste drums may be standard Transuranic (TRU) waste drums or Pipe Overpack Containers (POCs). In addition, wooden Low-Level Waste (LLW) crates may be received and stored under the Building 991 West Dock Canopy Area.

NSTR-011-98 addresses the identification and the evaluation of the hazards associated with the Building 991 Complex primary mission: movement and storage of hazardous radioactive materials/waste. It evaluates the consequences of postulated accidents leading to radiological and/or toxicological (chemical) releases which may be caused by internal, external, and natural phenomena-related events. NSTR-011-98 presents the evaluated potential consequences and risks (frequency times consequence) to workers, both immediate and collocated, and the public, as represented by the maximum [exposed] off-site individual (MOI) It also identifies preventive and/or mitigative features (structures, systems, and components (SSCs) or elements of administrative programs) credited to reduce risk by lowering postulated accident frequencies and/or by reducing receptor consequences so that an appropriate set of operational controls could be derived. In addition, discussions addressing hazard identification, hazard evaluation, accident analysis methodology, risk classification methodology, and final nuclear facility hazard classification are presented in NSTR-011-98.

4.2 REQUIREMENTS

The standards, regulations, and DOE Orders reviewed in support of the development of the AB for the Building 991 Complex are listed below. Only portions of the listed documents are relevant to this Final Safety Analysis Report (FSAR); namely, those that cover requirements

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pertinent to FSAR preparation, hazard identification and evaluation, Safety Analysis, risk classification, nuclear facility hazard classification, and operational controls. A comprehensive listing of standards and regulations addressing occupational safety and environmental protection is not provided.

- *Facility Safety*, DOE Order 420.1 (Ref. 2):

  This Order addresses operational controls dealing with Natural Phenomena Hazards Mitigation, Fire Protection, General Design Criteria, and Criticality Safety.

- *Nuclear Safety Analysis Reports*, DOE Order 5480.23 (Ref. 3):

  This Order specifies the requirement for FSAR preparation for nuclear facilities. The Order also specifies that the FSAR should include identification and evaluation of both nuclear and non nuclear hazards.

- *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, DOE Standard 1027-92 (Ref. 4):

  This Standard addresses nuclear facility hazard classification by defining threshold gram / curie facility inventory limits for various radionuclides corresponding to Hazard Category 2 and 3 nuclear facilities.

- *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*, DOE Standard 3011-94 (Ref. 5):

  This Standard addresses hazard identification and evaluation by providing guidance on performing a Preliminary Hazards Analysis (PHA). The Standard also addresses risk classification by defining candidate consequence evaluation guidelines and risk categories for postulated accident scenarios.

- *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, DOE Standard 3009-94 (Ref. 6):

  This Standard addresses FSAR preparation by providing guidance on the implementation of DOE Order 5480.23. The Standard also addresses hazard identification / evaluation and Safety Analysis by providing guidance on the analysis techniques and level of detail.

- *Nuclear Safety Management Quality Assurance Requirements*, Code of Federal Regulations, 10 CFR 830, Department of Energy, Washington, D. C., 1995 (Ref. 7).

  This Code of Federal Regulation (CFR) subpart addresses operational controls by prescribing quality assurance requirements that are generally applicable to DOE nuclear facilities.

4.3 METHODOLOGY

4.3.1 Overview of the Hazards and Accident Analysis Process

The Safety Analysis presented in NSTR-011-98 used a Preliminary Hazard Analysis (PHA) technique to identify and evaluate the hazards and postulated accident scenarios associated with the Building 991 Complex. This technique began by identifying existing or potential hazards (*e.g.*, radioactive sources, radioactive wastes, chemicals, or non-material hazards (*e.g.*, thermal energy sources, pressure sources, electrical energy sources)) in terms of quantity, form, packaging, location, affected or affecting activities, and recognized preventive and/or mitigative features (SSCs or elements of administrative programs) associated with the hazard.

Based on the information developed by the PHA and presented in the hazards description table, determinations were made on whether further evaluation of specific hazards were necessary. In general, no further evaluation was performed on those hazards: (1) which could be characterized as Standard Industrial Hazards and (2) which had limited impact on postulated accident initiation frequency, accident mitigation, and accident consequences. Industrial hazards that could only lead to occupational injuries or illnesses were considered addressed by the Industrial Hygiene and Safety program, as discussed in Chapter 3, *Safety Management Programs*.

For those hazards determined to require further evaluation, a hazards evaluation matrix was developed relating identified Building 991 Complex activities with corresponding hazards in order to derive postulated accident scenarios. For each postulated accident scenario, the hazards evaluation matrix presented: (1) scenario descriptive information including the corresponding activity and hazard leading to the scenario; (2) a categorization of the accident type; and (3) a qualitative assessment of scenario frequency, consequences, and risk class assuming identified, inherent preventive and mitigative features were in place. Based on the information presented in the hazards evaluation matrix, postulated accident scenarios of higher risk were selected as candidate, bounding accident scenarios for further, detailed evaluation. Bounding accident scenarios were identified for each of those postulated accident scenarios that were not carried forward for further analysis. Any inherent preventive and/or mitigative features associated with the bounded scenarios that resulted in the scenario being low risk were assigned to the bounding scenarios in order to carry forward all credited preventive and mitigative features.

In some cases, a bounding accident scenario qualitative frequency assessment may have been further refined using event tree methodology displaying accident progression and impact of identified preventive and/or mitigative features. In all cases, the bounding accident scenario qualitative consequence assessment was refined using Site consequence evaluation tools. Quantitative estimates of scenario initial [respirable] source terms (ISTs) were determined based on: (1) estimated damage ratios (DRs) associated with the postulated accident scenario; (2) bounding material-at-risk (MAR) estimates associated with analyzed activities and expected radioactive or chemical containers; and (3) airborne respirable release fractions (ARRFs) taken from *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear*

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Facilities, DOE-HDBK-3010-94 (Ref. 8), for radioactive material release scenarios. Scenario consequences were then determined using: (1) the ISTs; (2) estimates of applicable, facility leakpath factors; (3) Site atmospheric dispersion values; (4) receptor breathing rates for radioactive material releases; and (5) dose conversion factors for radioactive material releases. Risk classifications of the bounding accident scenarios were then determined using a qualitative binning methodology based on the refined accident frequency and the newly determined quantitative estimates of accident consequence.

In those cases where a bounding accident scenario was determined to present a high risk, evaluations were performed to identify any additional preventive or mitigative features that could be used to lower the scenario risk. This evaluation was presented in the Control Set Adequacy/Vulnerability section of each accident scenario. The adequacy of and vulnerability associated with credited preventive and mitigative features were presented for each accident scenario. Risk dominant accident scenarios (*i.e.*, scenarios presenting the highest risk following the crediting of preventive and mitigative features) at the completion of the Safety Analysis evaluations were then presented incorporating the results of the discussion in the Control Set Adequacy/Vulnerability section (this discussion has been repeated in this chapter in Section 4.6).

4.3.2 Risk Classification Methodology

The risks associated with postulated accident scenarios identified in the hazard evaluation tables or evaluated as bounding accident scenarios, as discussed in the previous section, were categorized according to a combination of the scenario frequencies and consequences, as shown in Table 4-1. The categorization bins accident scenario risk into one of four risk classes. For the purpose of this document, risks associated with Risk Class I accident scenarios were considered *major*, risks associated with Risk Class II scenarios were *serious*, Risk Class III accident scenario risks were *marginal*, and Risk Class IV accident scenario risks were considered *negligible*. In addition, Risk Class I and II accident scenarios were considered to be *high-risk* scenarios, and Risk Class III and IV scenarios were considered to be *low-risk* scenarios. The risk class associated with each of the accident scenarios identified and evaluated in NSTR-011-98 was determined based on the Table 4-1 categorization scheme.

Table 4-1 Risk Classes - Frequency Versus Consequence

	FREQUENCY OF OCCURRENCE		
CONSEQUENCE	EXTREMELY UNLIKELY $<10^{-4}$ events/year	UNLIKELY between 10^{-4} and 10^{-2} events/year	ANTICIPATED $>10^{-2}$ events/year
HIGH	II	I	I
MODERATE	III	II	I
LOW	IV	III	III

As stated earlier, inherent preventive and mitigative features required to be in place in order to maintain those Risk Class III and IV accident scenarios identified in the hazard evaluation tables as low-risk scenarios were carried forward with corresponding bounding accident scenarios. Postulated accident scenarios identified in the hazard evaluation tables as Risk Class I or II scenarios were evaluated further to determine if any preventive or mitigative features exist, which if implemented, could reduce the scenario risk to a Risk Class III or IV category. The collection of the credited preventive and mitigative features associated with initial and bounding scenario evaluations were then carried forward into the development of the control set in Appendix A, *Building 991 Complex Technical Safety Requirements*.

For those postulated accident scenarios that were evaluated to be Risk Class I or II scenarios and for which no preventive or mitigative features were identified to reduce the scenario risk class, discussions related to the acceptability of the high-risk scenarios was provided in the Control Set Adequacy/Vulnerability discussion of each accident scenario to ensure that the DOE is cognizant of facility risks.

The application of Table 4-1 requires frequency bin and consequence bin assignments. Frequency bin assignments are in accordance with DOE-STD-3011-94; *i.e.*, events more frequent than 10^{-2} per year are classified as *anticipated*, those with frequencies between 10^{-4} per year and 10^{-2} per year are classified as *unlikely*, and those less frequent than 10^{-4} per year are classified as *extremely unlikely*. These frequency bin terms and assignments are consistent with DOE-STD-3009-94 qualitative likelihood classifications. Low-likelihood high-risk scenarios were identified and discussed in those instances where the risk potential of the postulated accident scenario was judged to be significant relative to other credible scenarios. Estimates of scenario frequency are generally qualitative but may be quantitatively defined, in some cases, with the use of event trees. In cases where sufficient qualitative arguments for lower, accident scenario frequencies cannot be made, the scenario is classified as *anticipated*.

4.3.2.1 Radiological Risk

Radiological dose consequence evaluations were performed using the following equation:

$$\text{Dose} = \text{MAR} * \text{DR} * \text{ARRF} * \text{LPF} * \chi/Q * \text{BR} * \text{DCF} / \text{PDC}$$

where MAR is the radioactive material-at-risk (in grams, varies with scenario);
DR is the MAR damage ratio (varies with scenario);
ARRF is the airborne respirable release fraction (varies with form of radioactive material and scenario);
LPF is the facility leakpath factor (initially set to 1.0, varies with scenario);
χ/Q is the atmospheric dispersion factor (in s/m^3, varies with receptor and scenario);
BR is the receptor breathing rate (in m^3/s, set for heavy activity);
DCF is the radiological material dose conversion factor (in rem/gram, varies with material type); and

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PDC is the plume duration correction factor (varies with scenario).

The PDC value is used for accident scenarios with a duration longer than 10 minutes (*e.g.*, large fires). The PDC value is used to modify the atmospheric dispersion value to correct for plume meander during the scenario. The formula used for determining plume meander for longer duration releases is as follows:

$$PDC = (\text{plume duration in minutes / time base})^n$$

where the time base is 10 minutes; "n" has a value of 0.2 if the plume duration is less than or equal to 60 minutes; otherwise, "n" has a value of 0.25.

The atmospheric dispersion factors (χ/Q values) used in the radiological dose consequence evaluations are based on the receptor (*i.e.*, distance from the point of release), the type of accident scenario (*i.e.*, non-lofted plume or lofted plume), and modeling assumptions (*i.e.*, use of conservative 95^{th} percentile values or median (50^{th} percentile) values). In most cases, the atmospheric dispersion factors represent 95^{th} percentile χ/Q values developed from an analysis of actual Site weather data. Two receptors are identified for analysis: (1) the public as represented by the maximum off-site individual (MOI) and (2) the collocated worker (CW).

The shortest possible distance from the Building 991 Complex to a MOI located at the Site boundary was determined to be 2,367 meters using tables found in RFP-5098, *Safety Analysis and Risk Assessment Handbook* (SARAH) (Ref. 9) and this distance is used in the determination of MOI χ/Q values, in most cases, as part of radiological dose consequence evaluations. As in the case of the CW, if the maximum χ/Q value is realized at a distance greater than 2,367 meters as a result of accident scenario modeling assumptions, the higher χ/Q value is used in the analysis. For example, the maximum, 95^{th} percentile χ/Q value for the MOI for a lofted plume occurs at a distance of 4,020 meters since the plume is "lofted" over the MOI at the Site boundary, as discussed in RFP-4965, *Reference Computations of Public Dose and Cancer Risk from Airborne Releases of Uranium and Class W Plutonium* (Ref. 10).

The CW distance from the point of release, for most cases, has been set at 100 meters to be consistent with other safety analyses at the Site (*e.g.*, the Safety Analysis Reports (SARs) for Building 906 and the 750/904 Pads (Ref. 11 and Ref. 12, respectively)). This approach departs from the distance of 600 meters which is suggested for use by DOE-STD-3011-94 (Ref. 5). If the maximum χ/Q value is realized at a distance greater than 100 meters as a result of accident scenario modeling assumptions, the higher χ/Q value is used in the analysis. For example, the maximum, median χ/Q value for the CW for a lofted plume occurs at a distance greater than 100 meters since the plume is "lofted" over the CW at 100 meters. This overall approach for analyzing CW radiological dose consequences is more conservative than the DOE Standard approach and is appropriate for the following reasons: (1) many CWs are closer to the Building 991 Complex than 600 meters due to the proximity of other Site facilities and the compactness of the Site; (2) the minimum distance used in formulations supporting the Gaussian plume atmospheric dispersion model is 100 meters; and (3) distances associated with evaluated maximum χ/Q values occurring beyond 100 meters are encompassed by the Site boundary.

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The term "immediate worker" (IW) is used to describe the individual who could be located in close proximity to the postulated accident scenario release location or who could be located within the Building 991 Complex. For immediate worker consequences, a qualitative judgment of acute radiological effects is made. It does not include latent cancer effects, per the guidance provided in DOE-STD-3009-94 (Ref. 6). Scenario related effects (*e.g.*, burns from fires, injuries from energetic events) are discussed in the accident scenario summaries but are not included in the determination of the scenario risk class.

Radiological dose consequences corresponding to the High, Moderate, and Low consequence bins identified in Table 4-1 are defined by the comparison criteria developed in DOE-STD-3011-94 and shown in Table 4-2. Radiological dose consequence bin thresholds for the MOI and CW are defined in terms of 50-year, Committed Effective Dose Equivalent (CEDE) radiological doses. As stated above, radiological dose consequences for the IW are determined qualitatively; therefore, the radiological dose consequence bin thresholds for the IW are defined qualitatively.

Table 4-2 Radiological Dose Consequence Bin Thresholds

CONSEQUENCE	MOI DOSE CONSEQUENCE BIN THRESHOLD	CW DOSE CONSEQUENCE BIN THRESHOLD	IW CONSEQUENCE
HIGH	dose > 5 rem	dose >25 rem	prompt death {unmitigated/mitigated criticalities}
MODERATE	5 rem ≥ dose > 0.1 rem	25 rem ≥ dose > 0.5 rem	serious injury {unmitigated fires, explosions, spills; mitigated explosions}
LOW	0.1 rem ≥ dose	0.5 rem ≥ dose	< MODERATE {mitigated fires, spills}

Table 4-2 also displays a set of qualitative guidelines for assessment of immediate worker consequences. Deviations from these guidelines may occur for specific accident scenarios based on the amount of credit taken for mitigative features. Actual immediate worker consequence assessments take into account the following considerations:

- Timing of Radiological Release – Some accident scenarios, like fires, can develop quickly, but not so quickly as to preclude evacuation as an effective mitigation measure. Other scenarios, like criticalities or explosions, can entail significantly more rapid radiological exposure, lessening the impact of evacuation on consequences.

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- Hazard Warning – The availability of a reliable hazard warning and the timing of the warning relative to significant radiological exposure may impact immediate worker consequences. Warning may be provided by engineered systems (*e.g.*, fire alarms, warning announcements on the Life Safety/Disaster Warning (LS/DW) system) or by the event itself (*e.g.*, smoke from a fire, drum lid displacement).

- Scenario Impact on Protective Action Capability – Accident scenarios involving energetic events, like explosions, can cause damage to structures or injury to personnel. The structural damage and/or personnel injury can impede immediate worker egress, thus, increasing potential radiological consequences.

- Appropriate Focus for Preventive or Mitigative Measures – The only effective measures to protect the immediate worker for some accident scenarios, like criticalities, may be preventive. However, other workers in the facility may be aided by mitigative measures. Consequences to the attending worker in such an instance may not be a useful test of the adequacy of proposed mitigative measures.

- Potential Exposure Magnitude and Exposure Pathway – The severity of radiological injury is a function of the magnitude of the accident scenario release and the pathways for transport to and absorption by workers. Inhalation is typically the dominant exposure pathway.

- Consequence Uncertainty for the Immediate Worker – The radiological thresholds for prompt death and serious injury vary among individuals and are stochastic effects. In a quantitative immediate worker consequence evaluation, any defined radiological thresholds would have to be compared to localized radiological doses that are difficult to calculate and are beyond the scope of this effort. Thus, a qualitative evaluation of immediate worker consequences is implemented and the methodology employs conservatism. When the qualitative evaluation conservatism is combined with the effectiveness of imposed controls, the actual immediate worker protection may be more effective than a quantitative radiological threshold and evaluation would require.

Radiological doses for the MOI and CW were calculated using the *Radiological Dose Template* (Ref. 13) and are documented, along with the accompanying assumptions, in NSTR-011-98 (Ref. 1).

4.3.2.2 Chemical And Other Hazardous Material Risk

Toxicological consequence evaluations for postulated accident scenarios involving chemicals and other hazardous materials were determined using a combination of qualitative and quantitative evaluation techniques as discussed below. The receptors identified for analysis were: (1) the MOI; (2) the CW; and (3) the IW. The definition and location of the receptors of interest were the same as for the radiological consequence evaluations discussed in Section 4.3.2.1, *Radiological Risk*.

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Hazardous materials can exist throughout a facility and may be in various forms. In support of the determination of hazardous material risks, hazardous material inventories were defined in four general categories: (1) hazardous materials in waste; (2) process chemicals; (3) bulk or product chemicals; and (4) in situ hazardous materials.

The hazardous materials in waste category includes Resource Conservation and Recovery Act (RCRA) containerized wastes, Toxic Substances Control Act (TSCA) containerized wastes, and non-RCRA / non-TSCA hazardous material containerized waste. The containers utilized for holding hazardous materials include, in part, 55-gallon drums, metal standard waste boxes, and wooden waste crates. The hazardous materials, in many cases, may be located in the same containers as radioactive materials. Information regarding containerized waste may be obtained from the Site-wide Waste and Environmental Management System (WEMS) database or equivalent facility databases. These databases contain characterization information for each waste container including: waste type; container type; Item Description Code (IDC) designation; assigned Environmental Protection Agency (EPA) waste codes; and waste compatibility codes.

The process chemicals category includes chemicals that have been introduced into processes that were suspended or never activated or have been introduced into current operating processes. Any chemical holdup in solution piping is included in this category. Process chemicals, in some cases, may contain radioactive materials. Information about process chemicals is generally determined by interviews with facility personnel.

The product or bulk chemicals category includes chemicals that are planned for use and are currently being stored in the facility. Bulk chemicals are generally not contaminated with radioactive materials. Information about bulk chemicals may be obtained from the Site-wide Integrated Chemical Management System (ICMS) database or equivalent facility databases.

The in situ hazardous materials category includes hazardous materials that exist in the facility as part of structure (*e.g.*, lead-base paints located on walls and floors; asbestos containing ceiling panels, floor tiles, or walls; polychlorinated-biphenyl (PCB) containing equipment like fluorescent lighting or transformers). In general, in situ hazardous materials are fixed in place and, in some cases, may be contaminated with radioactive materials.

Hazardous chemicals and other materials in the facility that were identified as being in one of the four hazardous material categories were screened against: (1) the Threshold Planning Quantity (TPQ) values listed in *List of Regulated Substances and Thresholds for Accidental Release Prevention*, 40 CFR 355 (Ref. 14); (2) the Threshold Quantity (TQ) values listed in *Process Safety Management (PSM) of Highly Hazardous Chemicals*, 29 CFR 1910.119, (Ref. 15) and *Risk Management Programs for Chemical Accidental Release Prevention*, 40 CFR 68, (Ref. 16); and (3) the Reportable Quantity (RQ) values listed in *List of Hazardous Substances and Reportable Quantities*, 40 CFR 302 (Ref. 17). Hazardous materials of interest that may be found on the Site are listed in Appendix D of the SARAH (Ref. 9) along with TPQ, TQ, and RQ values. If the quantity of the hazardous material in the facility was below TPQ, TQ, and RQ values, the material did not require further evaluation.

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For hazardous materials that did not have TPQ or TQ values but did have RQ values and the quantity of material in the facility exceeded the RQ value, qualitative arguments dealing with dispersibility and programmatic controls associated with the hazard were used to complete the hazard evaluation. These types of hazardous materials, in general, only pose threats to the IW and/or the environment and not to the CW or the public.

For hazardous materials with facility quantities in excess of specified TPQ or TQ values, a quantitative evaluation of accidental releases of the material was performed. Determinations were made of chemical concentrations at the CW and MOI receptor locations using Site-accepted chemical dispersion modeling tools as identified in the SARAH (Ref. 9). There were no hazardous materials in the Building 991 Complex exceeding specified TPQ or TQ values.

For immediate worker consequences, a qualitative judgment of acute toxicological effects was made. Scenario related effects (*e.g.*, burns from fires, injuries from energetic events) were discussed in the accident scenario summaries but were not included in the determination of the scenario risk class.

Toxicological consequences corresponding to the High, Moderate, and Low consequence bins identified in Table 4-1 are defined by the comparison criteria developed in DOE-STD-3011-94 and shown in Table 4-3. Toxicological consequence bin thresholds for the MOI and CW are defined in terms of *Emergency Response Planning Guideline* (ERPG) values, published by the American Industrial Hygiene Association (Ref. 18). These guidelines include a set of three numbers (ERPG-1, ERPG-2, and ERPG-3) that quantify the air concentrations for each chemical, corresponding to *low, moderate,* and *severe* health effects in humans exposed to the chemical concentration up to one hour. The "up to one hour" guideline in the definition of ERPGs is interpreted to mean "peak 15-minute average" by the Energy Facility Contractors Group (EFCOG) Non-radiological Hazardous Materials Safety Analysis Subgroup. Concentrations of the various chemicals are calculated at the receptor locations and compared to the assigned ERPG values (or alternative values) in order to determine a consequence bin assignment in accordance with Table 4-3. The *Toxic Chemical Hazard Classification and Risk Acceptance Guidelines for Use in DOE Facilities* (Ref. 19) discusses alternative standards for cases where no ERPG value has been assigned. As stated above, toxicological consequences for the IW are determined qualitatively; therefore, the toxicological consequence bin thresholds for the IW are defined qualitatively.

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Table 4-3 Chemical Toxicological Consequence Bin Thresholds

CONSEQUENCE	MOI CONCENTRATION CONSEQUENCE BIN THRESHOLD	CW CONCENTRATION CONSEQUENCE BIN THRESHOLD	IW CONSEQUENCE
HIGH	concentration > ERPG-2	concentration > ERPG-3	prompt death
MODERATE	not applicable	not applicable	serious injury
LOW	concentration ≤ ERPG-2	concentration ≤ ERPG-3	< MODERATE

4.4 HAZARD ANALYSIS

4.4.1 Hazard Identification And Description

NSTR-011-98 (Ref. 1) identifies the radioactive materials and other hazardous materials present in the Building 991 Complex as well as identifying hazards and energy sources that may contribute to a radiological or toxicological release. Initial hazard identification for the complex was accomplished by reviewing radiological and other hazardous material inventories currently in the facilities, by interviewing facility personnel for additional hazardous materials that may be present during the conduct of Building 991 Complex activities, and by performing facility walkdown inspections.

A standardized general hazard checklist presented in the SARAH was used during the walkdown to identify the general hazard categories present in the Building 991 Complex. The SARAH (Ref. 9) describes the checklist and its application. The hazards specific to the Building 991 Complex were identified in the general hazard checklist. Of the 13 hazard categories appearing on the general checklist, 11 hazards were found to be present in the Building 991 Complex.

The general hazards identified were then summarized in more detail in a hazard description table in NSTR-011-98. The hazard description in the table and the corresponding text provided sufficient detail to justify the classification of identified hazards as Standard Industrial Hazards (*i.e.*, hazards which only lead to occupational injuries or illnesses and which have limited impact on postulated accident initiation frequency, accident mitigation, and accident consequences). Standard Industrial Hazards were considered to be sufficiently controlled by the set of SMP elements listed in Chapter 3, *Safety Management Programs*, and were not analyzed further in the NSTR-011-98. Hazards which were not classified as Standard Industrial Hazards were carried forward into the Safety Analysis.

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4.4.2 Hazard Classification

The DOE has provided guidance on the determination of a nuclear facility Hazard Category in DOE-STD-1027-92 (Ref. 4). The DOE Standard allows for the use of a facility inventory comparison to isotopic radiological thresholds, which are provided in the attachment to the Standard, to determine an initial nuclear facility Hazard Category. The determination of a facility Hazard Category primarily focuses on the radiological material inventories of the facility but consideration must be given to other hazardous materials or hazardous operations.

The Hazard Category of a nuclear facility is used, in part, to determine if the facility is exempt from the requirements of DOE Order 5480.23 (Ref. 3) to develop a facility Safety Analysis Report (SAR). In addition, the nuclear facility Hazard Category can be used as one consideration in the Safety Analysis graded approach concept.

The Building 991 Complex nuclear facility Hazard Category is initially determined using the isotopic radiological thresholds provided in the Standard. The radiological isotopes of interest for the Building 991 Complex include: (1) ^{239}Pu in WG Pu; (2) ^{241}Am in WG Pu and in higher concentrations associated with residue wastes; (3) ^{233}U in waste containers and Type B shipping containers; (4) ^{235}U in waste containers and Type B shipping containers; and (5) ^{238}U in waste containers and Type B shipping containers. The corresponding isotopic radiological thresholds are presented in Table 4-57.

Table 4-4 Hazard Category 2 and 3 Radiological Thresholds for Isotopes of Interest

	HAZARD CATEGORY 2 RADIOLOGICAL THRESHOLDS		HAZARD CATEGORY 3 RADIOLOGICAL THRESHOLDS	
ISOTOPE	ACTIVITY (Ci)	QUANTITY (g)	ACTIVITY (Ci)	QUANTITY (g)
^{233}U (criticality precluded)	220	23,000	4.2	440
^{233}U (criticality possible)	4.8	500	not applicable	not applicable
^{235}U (criticality precluded)	240	110,000,000	4.2	1,900,000
^{235}U (criticality possible)	0.0015	700	not applicable	not applicable
^{238}U	240	710,000,000	4.2	13,000,000
^{239}Pu (criticality precluded)	56	900	0.52	8.4
^{239}Pu (criticality possible)	28	450	not applicable	not applicable
^{241}Am	55	16	0.52	0.15

The Building 991 Complex may handle waste containers with maximum radioactive material loadings of weapons grade (WG) Pu equivalent (0.5 grams in a 55-gallon LLW drum; 3 grams in a wooden LLW crate; 200 grams in a 55-gallon TRU drum; 320 grams in a

TRUPACT II SWB or metal waste box; and 1,255 grams in a POC) and Type B shipping containers with up to 6,000 grams of WG Pu. The predominant radioactive materials that will be found in the Building 991 Complex are isotopes of plutonium blended with some americium rather than uranium. As shown in NSTR-011-98, the gram quantity radiological thresholds for ^{239}Pu and ^{241}Am are less than comparable uranium isotope radiological thresholds. In addition, the radiological consequences of uranium in Type B shipping containers or waste containers is bounded by equivalent containers of WG Pu. For the above reasons, the container inventories of uranium isotopes are not of interest.

Since the ^{239}Pu content of WG Pu is over 92% (see SARAH, Ref. 9), the upper bound WG Pu content of 5 TRU waste 55-gallon waste drums (approximately 920 grams of ^{239}Pu), 1 POC container (approximately 1,155 grams of ^{239}Pu), 4 TRUPACT II SWB containers (approximately 1,180 grams of ^{239}Pu), or 4 metal waste boxes (approximately 1,180 grams of ^{239}Pu), would exceed the Hazard Category 2 threshold for ^{239}Pu, even if a criticality is precluded. Since the Building 991 Complex can potentially store thousands of waste containers, the complex can be considered a Hazard Category 2 nuclear facility. This categorization would be true even if the waste containers had inventories closer to LLW rather than the upper bound WG Pu content of TRU waste.

Due to the potential ^{239}Pu content of the Building 991 Complex waste containers, the Building 991 Complex is considered a Hazard Category 2 nuclear facility based on exceeding the Hazard Category 2 radiological threshold for the isotope even though DOE-STD-1027-92 indicates that the inventory found in the Type B shipping containers does not have to be considered in the complex inventory.

4.4.3 Hazard Evaluation

The hazard identification process in NSTR-011-98 identified 44 hazards or energy sources for the Building 991 Complex. Of the 44 hazards, 22 hazards or energy sources were characterized as Standard Industrial Hazards, which did not need to be carried forward for further hazard evaluation or analysis. The remaining 22 hazards or energy sources were further evaluated using a hazard evaluation process prior to performing an accident analysis for the Building 991 Complex. The hazards of most interest were Hazard 4A, Category I and II SNM, and Hazard 4B, Waste Containers. The remaining hazards and energy sources either act on these hazards (*e.g.*, Hazard 7A, Vehicles, Material Handling Equipment) or are subsets of these hazards (*e.g.*, Hazard 5D, Pyrophoric Materials). In support of the hazard evaluation process, logic diagrams were developed displaying the manner in which each of the remaining hazards and energy sources acted on Hazard 4A and Hazard 4B. It was not considered necessary to determine how other hazards and energy sources acted on the chemicals since chemicals were considered to be Standard Industrial Hazards.

Initiating event trees were developed to link 20 of the 22 hazards/energy sources with releases of the two radioactive material hazards (*i.e.*, Category I and II SNM and waste containers). These event trees examined basic phenomenological mechanisms leading to failures of the SNM or waste containers. Paths through the event trees were preliminary accident

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scenarios. A total of 37 event tree paths or accident scenarios were determined to be credible scenarios for consideration and further analysis in the hazard evaluation process.

Based on defining eight general complex activities, five types of containers (*i.e.*, Type B, POC, TRU waste, metal LLW, and wooden LLW containers), and 37 preliminary scenarios, the hazard evaluation process potentially could look at 1,480 scenario combinations of scenarios (*i.e.*, 8 x 5 x 37). A hazard evaluation table was constructed which evaluated each scenario combination for likelihood and potential consequences. This process determined an initial risk class for each applicable and credible scenario. A total of 1,111 combinations were found to be not applicable, 205 combinations were not credible, and the remaining 164 combinations lead to credible scenario combinations with risk class designations based on DOE-STD-3011-94 methodology (Ref. 5). Seventy-nine of the 164 combinations were initially determined to be Risk Class I or Risk Class II accident scenarios. The scenario initial risk class determination was based on the CW being the most limiting receptor. Assumptions or protective features that were used in the determination of the not credible scenarios were carried forward in the analysis for inclusion in the final control set.

Bounding accident scenarios from the 164 scenario combinations were determined to reduce the number of scenarios that needed to be evaluated in the accident analysis. The intent of the process was to eliminate the evaluation of scenarios which would not provide: (1) any additional information about accident progression; (2) any additional understanding of facility risk; or (3) any additional control requirements associated with safe operations. The bounding accident scenario determination produced the following general accident scenarios for entry into the accident analysis process of NSTR-011-98:

1. Facility Fires

    - The *unlikely* impact of a facility fire on a waste container storage area inventory (for each of LLW and TRU waste containers).

    - The *extremely unlikely* impact of a transport vehicle fire at the dock on a transport vehicle inventory (for each of LLW and TRU waste containers).

    - The *extremely unlikely* impact of a direct flame impingement torch fire on a single POC container.

2. Spills

    - The *anticipated* spill of a single waste container or a single pallet of waste containers (for each of LLW and TRU waste containers).

    - The *unlikely* spill of an entire room or area of waste containers resulting from facility structural failures (for each of LLW and TRU waste containers) and the *extremely unlikely* spill of an entire room or area of POC containers resulting from facility structural failures.

3. Punctures

- The *anticipated* puncture of a single LLW container, the *unlikely* puncture of a single TRU waste container or a single pallet of TRU waste containers, and the *extremely unlikely* puncture of a single container (for each of Type B shipping and POC containers).

- The *unlikely* puncture of an entire room or area of waste containers resulting from facility structural failures (for each of LLW and TRU waste containers) and the *extremely unlikely* puncture of an entire room or area of POC containers resulting from facility structural failures.

4. Container Explosions

- The *extremely unlikely* explosion of a TRU waste container due to hydrogen generation and accumulation.

5. Facility Explosions

- The *extremely unlikely* impact of a facility explosion on a waste container storage area inventory (for each of LLW and TRU waste containers).

6. Criticalities

- The *unlikely* rearrangement of an entire room or area of TRU waste containers resulting from facility structural failures leading to a criticality and the *extremely unlikely* rearrangement of an entire room or area of POC containers resulting from facility structural failures leading to a criticality.

- The *extremely unlikely* rearrangement of an entire room of TRU waste containers resulting from a flammable gas explosion leading to a criticality.

7. Natural Phenomena and External Events

- Seismic events were determined to have the potential to initiate: (1) *unlikely* facility fire scenarios involving LLW and TRU waste containers; (2) *unlikely* spill scenarios involving LLW and TRU waste containers; (3) *extremely unlikely* spill scenarios involving POC and Type B shipping containers; (4) *unlikely* puncture scenarios involving LLW and TRU waste containers; (5) *extremely unlikely* puncture scenarios involving POC and Type B shipping containers; (6) *extremely unlikely* facility explosion scenarios involving LLW and TRU waste containers; (7) *unlikely* criticality scenarios involving TRU waste containers; and (8) *extremely unlikely* criticality scenarios involving TRU waste, POC, and Type B shipping containers;

- Lightning events were determined to have the potential to initiate: (1) *unlikely* facility fire scenarios involving LLW and TRU waste containers;

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(2) *extremely unlikely* facility explosion scenarios involving LLW and TRU waste containers; and (3) *extremely unlikely* criticality scenarios involving TRU waste containers;

- Aircraft crash events were determined to have the potential to initiate: (1) *extremely unlikely* facility fire scenarios involving LLW and TRU waste containers; (2) *extremely unlikely* spill scenarios involving LLW and TRU waste containers; (3) *extremely unlikely* puncture scenarios involving LLW and TRU waste containers; and (4) *extremely unlikely* criticality scenarios involving TRU waste containers;

- Range fire events were determined to have the potential to initiate: (1) *extremely unlikely* facility fire scenarios involving LLW and TRU waste containers;

- High wind events were determined to have the potential to initiate: (1) *anticipated* spill scenarios involving LLW and TRU waste containers; (2) *unlikely* spill scenarios involving POC containers; (3) *anticipated* puncture scenarios involving LLW and TRU waste containers; (4) *unlikely* puncture scenarios involving POC containers; (5) *anticipated* criticality scenarios involving TRU waste containers; (6) *unlikely* criticality scenarios involving POC containers; and (7) *extremely unlikely* criticality scenarios involving Type B shipping containers;

- Tornado events were determined to have the potential to initiate: (1) *unlikely* spill scenarios involving LLW and TRU waste containers; (2) *extremely unlikely* spill scenarios involving POC containers; (3) *unlikely* puncture scenarios involving LLW and TRU waste containers; (4) *extremely unlikely* puncture scenarios involving POC containers; (5) *unlikely* criticality scenarios involving TRU waste containers; and (6) *extremely unlikely* criticality scenarios involving POC and Type B shipping containers;

- Heavy rain events were determined to not have a credible potential to initiate any scenarios (flooding scenarios have little impact due to lack of contamination);

- Flooding events were determined to not have a credible potential to initiate any scenarios (flooding scenarios have little impact due to lack of contamination);

- Heavy snow events were determined to have the potential to initiate (1) *anticipated* spill scenarios involving LLW and TRU waste containers, (2) *unlikely* spill scenarios involving POC containers; (3) *extremely unlikely* spill scenarios involving Type B shipping containers; (4) *anticipated* puncture scenarios involving LLW and TRU waste containers; (5) *unlikely* puncture scenarios involving POC containers; (6) *extremely unlikely* puncture scenarios involving Type B shipping containers; (7) *anticipated* criticality scenarios involving TRU waste containers; (8) *unlikely* criticality scenarios involving POC containers; and (9) *extremely unlikely* criticality scenarios involving Type B shipping containers; and

- Freezing events were determined to not have a credible potential to initiate any scenarios (flooding scenarios have little impact due to lack of contamination).

The frequencies that were determined above, during the hazard evaluation process, were conservative estimates based on the assumptions, features, and requirements identified for the hazard evaluation. These frequencies were further refined during the accident analysis process.

4.5 ACCIDENT ANALYSIS

The accident analysis process examined each of the bounding accident scenarios. The examination and analysis performed multiple functions including: (1) determination of any potential analysis variations for each accident scenario (*e.g.*, a fire scenario can occur in an area supported by fire suppression and can occur in an area with no automatic fire suppression capability); (2) refinement of accident scenario progression; (3) refinement of accident scenario initial frequency bin assignment; (4) refinement of accident scenario initial consequence bin assignment; (5) determination of bounding accident scenario risk class; (6) identification of any additional protective features that could be credited to reduce the risk class associated with undesired, high risk, bounding accident scenarios; and (7) determination of the final prevented / mitigated accident scenario risk class.

There were six general types of accident scenarios identified in the Safety Analysis that could yield a radiological release as discussed above: (1) facility fire; (2) spill; (3) puncture; (4) container explosion; (5) facility explosion; and (6) criticality. These six general types of scenarios may be initiated by internal, natural phenomena, and external events. There may be multiple specific accident scenarios identified within each general type of accident scenario to cover variations in initiating events within a general scenario type and to cover variations in accident locations within the Building 991 Complex in the case of internal initiating events. Natural phenomena and external event accident scenarios were analyzed in a global fashion and evaluated all potential types of accidents that could result from the external initiating event (*e.g.*, a seismic event may initiate facility fires, spills, punctures, facility explosions, and criticalities).

The identified accident scenarios may impact up to five types of radioactive material containers which are distinguished by the type of radioactive material that they contain, the quantity of radioactive material that they contain, and the resistance of the container to various accident scenarios. The five containers defined for the Safety Analysis were: (1) Type B shipping containers; (2) POCs; (3) metal TRU waste containers, drums or boxes; (4) metal LLW containers, drums or boxes; and (5) wooden LLW boxes/crates. Radioactive material contained as contamination in filter plenums, in ducting, in various components, and on structures was determined to represent a Standard Industrial Hazard due to negligible contamination levels and was not included in the accident analysis portion of the Safety Analysis.

The identified accident scenarios may also impact non-radioactive, hazardous material containers. Non-radioactive hazardous materials in the Building 991 Complex were determined to represent a Standard Industrial Hazard due to relatively low quantities and/or toxicity and were not included in the accident analysis portion of the Safety Analysis.

For each scenario type/container type combination, the accident analysis investigated the consequences associated with the accident scenario for three receptors: (1) the public, as represented by the MOI; (2) the CW; and (3) the IW. The MOI and CW consequence evaluations were quantitative while the IW consequence evaluation was strictly qualitative.

4.5.1 Accident Scenario Discussions and Accident Scenario Summary Tables

The purpose of the accident analysis portion of the Safety Analysis was to refine the assessment of the risk associated with facility operation and to determine the appropriate set of protective features or controls to ensure safe operation. Risk assessment refinement can be accomplished by improving the understanding of accident scenario progression, by improving the quality of the estimate of the scenario frequency, and by improving the assessment of accident scenario dose consequences. Appropriate control set determination can be accomplished by initially crediting a set of protective features/controls that were expected to be in place during operation, by assessing the acceptability of the scenario risk under the expected set of controls, and by identifying appropriate controls for scenario risk reduction in cases where the scenario risk is unacceptable. Control appropriateness may be determined using multiple factors including: (1) risk reduction benefit; (2) control cost; (3) degree of unacceptable risk; and (4) control impact on operations.

For each specific bounding accident scenario analyzed, an accident scenario discussion and corresponding summary table were developed. The scenario discussion and summary table presented information describing: (1) the accident scenario sequence; (2) the assumptions made in the analysis of the scenario; (3) the frequency bin assignment for the accident scenario, potentially under multiple sets of credited protective features; (4) the dose consequence and/or consequence bin assignment for the scenario, potentially under multiple sets of credited protective features; (5) the corresponding scenario risk class for these situations; (6) the sets of credited and defense-in-depth protective features associated with scenario prevention and mitigation; and (7) the credited protective feature set adequacy and vulnerability.

Descriptions of the final set of analyzed accident scenarios are provided below followed by a summary table of the final results of the accident analysis. The summary table provides a short description of the accident scenario, the "with prevention" frequency, the "with mitigation" consequences, and the "with prevention" and "with mitigation" risk class for each receptor. The descriptions below also identify those bounding accident scenarios presented in Section 4.4.3 that were eliminated from further analysis based upon the bounding accident discussion.

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Facility Fire Scenarios

Facility Fire Scenario 1 - 1 MW TRU Waste Drum Facility Fire: This facility fire involves the contents of 3 TRU waste drums located in either the Building 996, north or south waste storage areas. This scenario is assigned an *unlikely* frequency in each of the Building 991 Complex metal waste container storage areas. The facility fire is assumed to pyrolize the combustible contents of the 3 drums (600 grams WG Pu equivalent potentially involved) and release the radioactive material through drum seals that fail due to the fire. The facility fire is evaluated as occurring in Room 170 but could occur in the other portions of the south waste storage area, the north waste storage areas, or in the Building 996 waste storage area.

Facility Fire Scenario 2 - 2 MW TRU Waste Drum Facility Fire: This facility fire involves the contents of 6 TRU waste drums located in the south waste storage areas. This scenario bounds or envelopes other facility fire scenarios due to the assignment of an *extremely unlikely* frequency (same size fire in north waste storage area is a *beyond extremely unlikely* event and same size fire in Building 996 waste storage area is an order of magnitude less likely to occur even thought its in the same frequency bin) or due to the number of containers involved in the fire (same size fire in north waste storage area has same frequency but involves fewer drums). The facility fire is assumed to pyrolize the combustible contents of the 6 drums (1,200 grams WG Pu equivalent potentially involved) and release the radioactive material through drum seals that fail due to the fire. The facility fire is evaluated as occurring in Room 170 but could occur in the other portions of the south waste storage area, the north waste storage areas, or in the Building 996 waste storage area.

Facility Fire Scenario 3 - Medium to Large Wooden LLW Crate Facility Fire: This facility fire involves the contents of 4 wooden LLW crates located in the West Dock Canopy waste storage area. This scenario does not bound or envelop any other facility fire scenarios and has an assignment of an *unlikely* frequency. The facility fire is assumed to ignite the combustible contents of the 4 crates (12 grams WG Pu equivalent potentially involved) and directly release the radioactive material. The facility fire is evaluated as occurring in the West Dock Canopy waste storage area.

Facility Fire Scenario 4 - Major Wooden LLW Crate Facility Fire: This facility fire involves the contents of 50 wooden LLW crates located in the West Dock Canopy waste storage area. This scenario bounds another facility fire scenario due to the number of containers involved in the fire (smaller fire of same frequency in the West Dock Canopy waste storage area involves only 30 crates) and has an assignment of an *extremely unlikely* frequency. The facility fire is assumed to ignite the combustible contents of the 50 crates (150 grams WG Pu equivalent potentially involved) and directly release the radioactive material. The facility fire is evaluated as occurring in the West Dock Canopy waste storage area.

The *extremely unlikely* impact of a transport vehicle fire at the dock on a transport vehicle inventory was determined to be a *beyond extremely unlikely* event based on the analysis of vehicle fires presented in NSTR-015-97, *Salt Stabilization Program Transportation Risk* (Ref. 20), and in NSTR-018-97, *Evaluation of Risk Associated with Transportation Activities within the Protected Area* (Ref. 21). These reports evaluated the possibility of a vehicle fire initiated by an electrical malfunction or short that results in a fire in the engine compartment. The evaluations assumed that the fire spreads through the fuel system or spreads via leaking fuel until it breaches the vehicle fuel tanks. The transport vehicle fire scenario was postulated to occur regardless of whether the transfer vehicle is located at the dock or in transit. These reports determined there were no credible transport vehicle fire events at the building docks and the analysis performed was determined to be appropriate for the Building 991 Complex docks, therefore no further analysis of this event was performed.

The *extremely unlikely* impact of a direct flame impingement torch fire on a single POC container was determined to be a *beyond extremely unlikely* event based upon the work controls that have to be in place when doing hot work and the substantial construction (i.e., radioactive material packed in metal boxes which are inside a pipe component which is surrounded by packaging which is inside a metal drum). No further analysis of this event was performed.

Spill Scenarios

Spill Scenario 1 - TRU Waste Drums Drop/Fall: This spill involves the contents of four 55-gallon waste drums. These drums are assumed to be breached due to impact with a concrete surface from a drop/fall from a height greater than four feet. The four drums are un-banded and on a pallet that is being stacked on the third tier or the stacked drums are impacted by material handling equipment and four drums fall from the third tier. This scenario bounds other mechanisms for container breach due to the *anticipated* frequency of the scenario and due to the effective MAR involved in this scenario.

Spill Scenario 2 - Facility Structural Failure Spill: This scenario involves 55-gallon TRU waste drums being breached due to structural failure of the hallway where the waste containers are stored. This scenario bounds other mechanisms for facility structural failure caused spills due to the *unlikely* (TRU waste drums) frequencies associated with the scenario.

Puncture Scenarios

Puncture Scenario 1 - LLW, TRU, POC, and Type B Container Punctures: This puncture scenario involves the contents of either a LLW, TRU, POC, or Type B container. LLW and TRU waste containers are assumed to be breached during movement operations due to a forklift tine puncture of the container. The puncture of POC and Type B containers will be evaluated to determine potential consequences but is not considered to be a credible accident scenario. The wooden LLW crate puncture can occur in the West Dock Canopy Area (at the time of lifting for removal from storage or

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placing into storage) and the TRU waste container punctures can occur in all storage areas (at the time of removing or placing into storage) or at the west or east dock (at the time of lifting for receipt of the container or following a material handling vehicle transfer of the container prior to loading onto a transport vehicle).

Further analysis of the *unlikely* puncture of an entire room or area of waste containers resulting from facility structural failures and the *extremely unlikely* puncture of an entire room or area of POC containers resulting from facility structural failures was not performed based upon the similarity of this scenario with Spill Scenario 2. The bounding analysis discussion determined that the controls specified in Spill Scenario 2 would be the same as the controls determined from a detailed accident analysis of this scenario.

Container Explosion Scenarios

Container Explosion Scenario 1 - TRU Waste Box Container Explosion: This container explosion involves the contents of one TRU waste box. The box is assumed to have accumulated hydrogen from radioactive material content radiolysis processes and ignition mechanisms for the accumulated hydrogen are prevalent and uncontrollable. The container hydrogen explosion results in the loss of the waste container lid and release of some of the radioactive material contents of the container. The largest inventory TRU waste container is assumed in the analysis (*i.e.*, a TRU metal waste box or TRUPACT II SWB containing up to 320 grams, WG Pu equivalent). The container hydrogen explosion can occur throughout the Building 991 Complex where TRU waste containers are handled or stored. The event can occur at the west dock and Room 170, and the east dock, in any of the waste storage areas, or in hallways used for waste container transit between the docks and the waste storage areas.

Facility Explosion Scenarios

Facility Explosion Scenario 1 - Explosion in Waste Container Storage Area: This facility explosion is assumed to occur following a release of acetylene gas into a waste container storage room with a deflagration limited to a localized air/acetylene mixture within the flammable range. This postulated explosion impacts the entire radiological waste container inventory of the specific waste container storage area (room) where the explosion occurs. Room inventories consist of radioactive materials packaged in Type B shipping containers, POC containers, metal TRU waste containers, metal LLW waste containers, and wooden LLW waste containers. Type B shipping containers and POC containers were excluded from further evaluation based on crediting Feature F8 and Feature F9, which state that Type B shipping containers and POC containers cannot be breached by any external flammable gas explosions expected during facility operation Therefore, the likelihood of a facility explosion impacting Type B shipping or POC containers is considered to be a *beyond extremely unlikely* event.

Two potential causes of a facility explosion were eliminated during the bounding accident scenario discussion, a propane explosion caused by a propane release from the

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750 Pad tank farm that migrates to Building 991 and a natural gas explosion due to a leak in the natural gas line that feeds the hot water boilers for Building 991. Based upon information provided in calculation CALC-RFP-98.0555-RGC (Ref. 22) and the distance that Building 991 is from the 750 Pad tank farm, it was determined to be a *beyond extremely unlikely* event that concentrations of propane above the flammability limit would migrate down to Building 991. Restricting Room 166 to storage of POC containers eliminates the concern with natural gas explosions since the POC containers are considered to be undamaged by any flammable gas explosions expected during operations.

Criticality Scenarios

This scenario was eliminated from further analysis during the bounding accident scenario discussion. This discussion determined that a floor collapse scenario leading to a criticality and a facility explosion scenario leading to a criticality were *beyond extremely unlikely* events.

NPH/EE Scenarios

NPH/EE Scenario 1 - DBE Event-Induced Spill: This scenario involves a DBE resulting in damage to overhead equipment and material that is not seismically rated. This results in damage to waste containers in the facility. The DBE is an *unlikely* event.

NPH/EE Scenario 2 – BDBE Event-Induced Spill: This scenario involves a beyond DBE resulting in structural damage and collapse of the building and toppling of stacked containers. This scenario is in the same frequency bin as the DBE and is considered an *unlikely* event.

NPH/EE Scenario 3 – Heavy Snow Event-Induced Spill: This scenario involves a heavy snow resulting in structural damage and collapse of the building. This scenario is an *unlikely* event.

The following NPH/EE scenarios were eliminated from further analysis during the bounding accident scenario discussion:

- Lightning events were determined to be an initiator for facility fires, but the lightning initiated fire was bounded by Facility Fire Scenarios 1 and 2.
- Destructive tornadoes were determined to be *beyond extremely unlikely* events for the Site. High winds were evaluated and it was determined that damage to portions of Building 991 storing radioactive waste containers (Rooms 166 and 170 specifically) could be expected due to atmospheric pressure changes. The damage to waste containers from an atmospheric pressure change would be bounded by an earthquake caused spill event. Wind missiles were also evaluated. A timber plank missile was assumed to penetrate Rooms 166 and 170 and a steel pipe missile was assumed to penetrate Rooms 134, 166 and 170 due to the roof

thicknesses. Damage to waste containers in these storage areas would be expected. Extremely high winds were evaluated and it was determined that at a minimum the Building 991 Complex met PC-3 criteria. Based upon the analysis, it was determined that the tornado, high wind, atmospheric pressure changes, and tornado or wind-driven missile events were bounded by an earthquake caused spill event.

- Evaluation of heavy rain, flooding, and freezing determined that these events do not have a credible potential to initiate any scenarios. The bounding accident scenario discussion also evaluated runoff flooding, ponding, and a rain and snow combination. Runoff flooding would have no adverse impact on waste container storage. Ponding on the roof, assuming the roof drains were plugged, was determined to be a *beyond extremely unlikely* event. A rain and snow event was determined to be bounded by the heavy snow event.

- Aircraft crashes were evaluated and it was determined that the only vulnerable waste storage areas in the Building 991 Complex were Room 166 and Room 170. An evaluation of these areas determined the aircraft crash scenario to be a *beyond extremely unlikely* event.

- Range fires were evaluated and it was determined that due to the located of the Building 991 Complex inside the protected area boundary, the roadways and parking lots that provide a substantial fire break, and the training provided to the Site Fire Department, that a range fire would result in insignificant radiological consequences.

Table 4-5 Summary Table of Accident Analysis Results

Accident Scenario Description	Receptor	Scenario Frequency With Prevention	Scenario Consequences With Mitigation (rem)	Scenario Risk Class With Prevention/Mitigation
Facility Fire Scenario 1: Facility fire involving up to 3 TRU waste drums.	MOI	Unlikely	Moderate (0.26)	II
	CW		High (35)	I
	IW		Low	III
Facility Fire Scenario 2: Facility fire involving up to 6 TRU waste drums.	MOI	Extremely Unlikely	Moderate (0.52)	III
	CW		High (71)	II
	IW		Low	IV
Facility Fire Scenario 3: Facility fire involving up to 4 wooden LLW crates.	MOI	Unlikely	Low (0.0048)	III
	CW		Moderate (0.66)	II
	IW		Low	III
Facility Fire Scenario 4: Facility fire involving up to 50 wooden LLW crates. [30 minute fire, lofted plume]	MOI	Extremely Unlikely	Low (0.0068)	IV
	CW		Low (0.24)	IV
	IW		Low	IV
Spill Scenario 1: Spill involving a pallet of 55 gallon TRU waste drums.	MOI	Anticipated	Low (0.023)	III
	CW		Moderate (3.1)	I
	IW		Low	III
Spill Scenario 2: Spill involving TRU waste drums stacked on floor above basement utility tunnel.	MOI	Extremely Unlikely	Moderate (0.17)	III
	CW		Moderate (24)	III
	IW		Low	IV

Table 4-5 Summary Table of Accident Analysis Results

Accident Scenario Description	Receptor	Scenario Frequency With Prevention	Scenario Consequences With Mitigation (rem)	Scenario Risk Class With Prevention/Mitigation
Puncture Scenario 1 (Case A): Puncture of wooden LLW crate.	MOI	Anticipated	Low (3.4E-04)	III
	CW		Low (0.047)	III
	IW		Low	III
Puncture Scenario 1 (Case B): Puncture of 2 TRU drums.	MOI	Unlikely	Low (0.046)	III
	CW		Moderate (6.2)	II
	IW		Low	III
Puncture Scenario 1 (Case C): Puncture of a single POC.	MOI	Beyond Extremely Unlikely	Low (0.029)	not applicable
	CW		Moderate (3.9)	
	IW		Low	
Puncture Scenario 1 (Case D): Puncture of a single Type B shipping container.	MOI	Beyond Extremely Unlikely	Moderate (2.9)	not applicable
	CW		High (390)	
	IW		Low	
Container Explosion Scenario 1: Container explosion involving a single TRU waste box.	MOI	Extremely Unlikely	Moderate (2.6)	III
	CW		High (350)	II
	IW		Moderate	III
Facility Explosion Scenario 1: Facility Explosion involving 10 TRU waste drums.	MOI	Extremely Unlikely	Moderate (0.17)	III
	CW		Moderate (24)	III
	IW		Moderate	III

Table 4-5 Summary Table of Accident Analysis Results

Accident Scenario Description	Receptor	Scenario Frequency With Prevention	Scenario Consequences With Mitigation (rem)	Scenario Risk Class With Prevention/Mitigation
NPH/EE Scenario 1- DBE Event: Spill involving 20 TRU waste drums.	MOI	Unlikely	Moderate (0.35)	II
	CW		High (48)	I
	IW		Moderate	II
NPH/EE Scenario 2 – BDBE Event: Spill involving 101 TRU waste drums.	MOI	Unlikely	Moderate (1.7)	N/A
	CW		High (240)	Beyond Design
	IW		Moderate	Basis Event
NPH/EE Scenario 3 – Heavy Snow Event: Spill involving 13 TRU waste drums.	MOI	Unlikely	Moderate (0.22)	N/A
	CW		High (30)	Beyond Design
	IW		Low	Basis Event

4.6 RISK DOMINANT ACCIDENT SCENARIOS

This section discusses the dominant risk contributors to the MOI, CW, and IW. These accident scenarios have significant risk even after crediting preventive and mitigative features, and are categorized as Risk Class I or Risk Class II for at least one of the three receptors. Of the dominant risk accident scenarios, no scenarios resulted in *high* consequences to the MOI, three scenarios resulted in *high* consequences to the CW, and no scenarios resulted in *high* consequences to the IW.

Table 4-6 summarizes the risk dominant accident scenarios that were identified for the Building 991 Complex. The first column of the table lists the risk dominant accident scenario and provides a brief description of the accident. The *Analyzed Risk Class* columns identify the risk for each receptor as analyzed in the accident analysis section. The frequency bin, consequence bin, dose consequence, and risk class for each receptor (IW does not have a dose consequence), as analyzed, are provided for the accident scenario. The *Additional Considerations for Risk Reduction* columns identify the risk for the receptor of concern after additional considerations are taken into account. These considerations may deal with a relaxation of the conservative modeling input assumptions utilized in the accident analysis and how using more realistic assumptions could reduce the frequency or consequences of the event (*e.g.*, use of median χ/Q values, use of more realistic MAR values). The considerations could also deal with additional preventive/mitigative features that were not taken credit for in the accident analysis that could reduce the frequency or consequences of the event. The *Risk Reduction Remarks* column provides a brief description of the consideration(s) used to reduce the risk. A detailed discussion of the risk reduction consideration is provided for each risk dominant accident scenario.

Facility Fire Scenario 1 – 1 MW TRU Waste Drum Facility Fire

A facility fire is postulated to impact up to three 55-gallon waste containers. The facility fire is postulated to occur as a result of combustibles (modeled as wooden pallets with a total heat load of 1 MW) being ignited during the conduct of hot work or by exposure to electrical system components. The facility fire may occur in Building 996, any north waste storage area, or any south waste storage area. The facility fire is assumed to initially involve combustible materials located in close proximity to stored waste containers. The fire causes heating of the waste containers and their contents, pyrolyzing of the container contents, and subsequent venting of container gases containing radioactive material through failed container lid seals. This size fire is postulated to activate the automatic sprinkler system in the north waste storage areas (excluding Building 996) but the sprinkler system does not reduce the number of drums involved in the fire in this area. The automatic sprinkler system is not activated in the south waste storage area due to ceiling height.

The postulated facility fire involving three 55-gallon TRU waste drums in the Building 991 Complex is considered to be an *unlikely* event with *moderate* consequences for the MOI, *high* consequences for the CW, and *low* consequences for the IW. The MOI and CW risk

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classes are Risk Class II and Risk Class I, respectively. The risk class for the IW is Risk Class III, which is considered to be acceptable.

Portions of the waste storage areas for the Building 991 Complex have filtered exhaust ventilation. Specifically, the north waste storage areas and the Building 996 waste storage area are ventilated. The south waste storage areas (excluding Room 166), while not directly supported by a filtered exhaust ventilation system, have sufficient negative differential pressure with respect to atmosphere under certain configurations to credit the filtration provided by the north waste storage area ventilation system. The fire being evaluated is not expected to challenge the ventilation system's ability to maintain a negative pressure in the north, Building 996, and most of the south waste storage areas. The fire may or may not impact the high efficiency particulate air (HEPA) filters due to blinding or blockage from fire related particulate accumulation on the filters, depending on the quantity of smoke generated by the fire. The blockage of the filters due to smoke is not considered a rationale for discrediting the mitigative effects of the filtered exhaust ventilation systems. The north and most south waste storage areas, excluding Building 998, have the potential to exhaust through a single stage of HEPA filtration. Building 996 and Building 998 are potentially exhausted through two stages of HEPA filtration (*i.e.*, Building 996 through two stages in Building 985 and Building 998 through a single, Building 998 dedicated stage and a single stage in the Building 991 filter plenum). Crediting a single tested stage filter efficiency of 0.999 would reduce the risk class for both the MOI and the CW to Risk Class III (MOI *low* consequence of 2.6E-4 rem; CW *low* consequence of 3.5E-2 rem).

In order to credit the filtered exhaust ventilation system for mitigation of the three drum fire, an acceptable facility configuration must be defined. The Building 991 exhaust ventilation system can support mitigation of accident scenarios in all interior container storage/staging areas except for Room 166. An operations restriction to permit ***only POCs to be stored in Room 166*** is imposed to reduce concerns dealing with exterior natural gas lines located outside of Room 166. This same control shall be used to negate concerns about a lack of a ventilation system supporting Room 166 for the mitigation of a three drum fire.

As stated above, the ***Building 991 filtered exhaust ventilation system*** supports all other areas. The north waste storage areas are directly supported by this system. Building 996 and Corridor B are normally supported by the Building 985 filtered exhaust ventilation system, but the Building 991 system can cover these areas if the Building 985 system is not being used. However, if the Building 985 exhaust ventilation system is used to support personnel access to the tunnel and vault areas, a ***stage of tested HEPA filtration in Building 985*** is required. The tested stage is used to mitigate fires in the Building 996 waste container storage areas and to mitigate some fires in the Building 991 container storage/staging areas (*i.e.*, some areas of Building 991 are ventilated by Building 985 due to competitive suction between the two ventilation systems) for fires occurring while the Building 985 system is operating.

The south waste container storage areas, other than Room 166, are supported by the ***Building 991 filtered exhaust ventilation system*** under certain facility configurations. The waste container storage areas being supported are Room 134 (including connected Room 135)

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and Room 170 (including connected Room 147). The two main rooms must have an airflow connection, in some way, to the north areas of Building 991 in order that a negative differential pressure with respect to atmosphere can be created in areas. The following ***facility configurations*** are considered to be acceptable for providing an airflow connection from the south areas to the north areas of Building 991:

- For Room 134 (and Room 135):

    1. Airlock doors in the north-south running corridor (connected to the east side of Room 134) are open.
    2. Roll-up door between Rooms 134 and 170 is opened **AND** door between Rooms 170 and 140/141 is open.
    3. Roll-up door between Rooms 134 and 170 is open **AND** roll-up door between Rooms 170 and 147A (connection to the east-west running corridor in the north area) is open.

- For Room 170 (and Room 147) [Note: this configuration control is imposed by a ***Room 170 differential pressure*** requirement rather than a door alignment requirement]:

    1. Door between Rooms 170 and 140/141 is open.
    2. Roll-up door between Rooms 170 and 147A (connection to the east west running corridor in the north area) is open.
    3. Roll-up door between Rooms 134 and 170 is open **AND** airlock doors in the north-south running corridor (connected to the east side of Room 134) are open.

If the Room 170 dock doors are open, an airflow through the dock doors into Room 170 may exist but no credit is taken for exhaust filtration in Room 170 while the doors are open. That is, accident scenarios in Room 147 and 170 occurring when Room 170 dock doors are open are unmitigated. In order to ensure that three drum fires in Room 170 are mitigated, a control to restrict operations in Rooms 147 and 170 when the dock doors are open is required. However, the dock doors must be open during receiving and shipping operations in Room 170.

Receipt and shipment operations in Room 170 are defined as follows:

- Movement of waste containers from a transport vehicle at the dock to a staging area in Room 170.
- Movement of waste containers from a staging area in Room 170 to a transport vehicle at the dock.
- Movement of SNM Type B shipping containers from a transport vehicle at the dock to a vault staging location in the north area of the facility.
- Movement of SNM Type B shipping containers from a vault staging location in the north area of the facility to a transport vehicle at the dock.

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All other container movement within Room 170 or from/to Room 170 are not considered to be part of receipt and shipment operations.

Receiving and shipping activities potentially involve the use of electric powered forklifts and may introduce some combustibles into the area (*e.g.*, wooden pallets, combustible material supplies). However, the entire activity is conducted with personnel present. A control to ***restrict all operations, other than receipt and shipment, in Rooms 147 and 170 when dock doors are open*** is imposed to reduce the likelihood of fires and other accident scenarios in the area while the dock doors are open. Therefore, it is postulated that the likelihood of a three drum fire occurring during the conduct of receiving or shipping operations is remote for the following reasons:

1. Personnel are always in attendance during the conduct of the activities, allowing for mitigation of any small fires occurring in the area before waste containers become involved in the fire
2. Receiving and shipping operations do not involve significant ignition sources (*e.g.*, only electric powered forklifts versus items like oxyacetylene torches).
3. Combustibles involved in receiving and shipping operations are well controlled and monitored (*e.g.*, wooden pallets, if any, are collected and placed in areas away from waste containers before removal from the facility).
4. All other operations, including hot work, are suspended while receiving and shipping operations are being conducted.

Therefore, if the operations restrictions are imposed, all facility three drum fires can be analyzed crediting a stage of HEPA filtration.

When the ***filtered exhaust ventilation system*** is credited for fire scenario mitigation, there is a possibility that the fire may impact the HEPA filters due to high air temperatures or hot embers and flying brands. Either of these impacts can result in the ignition of the filter stage, release of radioactive materials that were captured on the filter stage, and subsequent loss of filtration capability. However, the three drum fire scenario is not expected to challenge the filters due to elevated temperatures. It is also not expected that the three drum fire will have sufficient generation of hot embers and flying brands to challenge the filters due to hot particulates.

In summary, crediting the ***Building 991 filtered exhaust ventilation system*** and ***facility configuration*** controls would yield Risk Class III results for the MOI and the CW.

Facility Fire Scenario 2 – 2 MW TRU Waste Drum Facility Fire

A facility fire is postulated to impact up to six 55-gallon waste containers. The facility fire is postulated to occur as a result of combustibles (modeled as wooden pallets with a heat load of 2 MW) being ignited during the conduct of hot work or by exposure to electrical system components. The facility fire may occur in the south waste storage area, north waste storage

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area, or the Building 996 waste storage area. The facility fire is assumed to initially involve combustible materials located in close proximity to stored waste containers. The fire causes heating of the waste containers and their contents, pyrolyzing of the container contents, and subsequent venting of container gases containing radioactive material through failed container lid seals. This size fire is postulated to activate the automatic sprinkler system in the north waste storage areas (excluding Building 996). Activation of the automatic sprinkler system may or may not occur in the south waste storage areas due to ceiling height; however, the automatic sprinkler system is credited as a preventive/mitigative feature. The consequences of this event are reduced if the automatic sprinkler system activates (postulated that the fire will impact three 55-gallon waste containers if the automatic sprinkler system activates).

The postulated facility fire involving six 55-gallon TRU waste drums in the Building 991 Complex is considered to be an *extremely unlikely* event with *moderate* consequences for the MOI, ***high*** consequences for the CW, and *low* consequences for the IW. The CW risk class is Risk Class II. The risk classes for the MOI and IW are Risk Class III and Risk Class IV, respectively, which are considered to be acceptable.

The analysis of the south waste storage area fires assumes that a 2 MW fire would not set off the automatic fire suppression systems in the south waste storage areas due to the high ceilings in these locations. It is possible that the sprinkler system would actuate and suppress the fire to, at worst, a three drum fire. Larger, six drum fires would become ***not credible*** events as in the case of the north waste area fires if the automatic sprinkler system is actuated.

Portions of the waste storage areas for the Building 991 Complex have filtered exhaust ventilation. Specifically, the north waste storage areas and the Building 996 waste storage area are ventilated. The south waste storage areas (excluding Room 166), while not directly supported by a filtered exhaust ventilation system, have sufficient negative differential pressure with respect to atmosphere under certain configurations to credit the filtration provided by the north waste storage area ventilation system. The fire being evaluated is not expected to challenge the ventilation system's ability to maintain a negative pressure in the north, Building 996, and most of the south waste storage areas. The fire may or may not impact the high efficiency particulate air (HEPA) filters due to blinding or blockage from fire related particulate accumulation on the filters, depending on the quantity of smoke generated by the fire The blockage of the filters due to smoke is not considered a rationale for discrediting the mitigative effects of the filtered exhaust ventilation system. The north and most south waste storage areas, excluding Building 998, have the potential to exhaust through a single stage of HEPA filtration. Building 996 and Building 998 are potentially exhausted through two stages of HEPA filtration (*i.e.*, Building 996 through two stages in Building 985 and Building 998 through a single, Building 998 dedicated stage and a single stage in the Building 991 filter plenum) Crediting a single tested stage filter efficiency of 0.999 would reduce the risk class for both the MOI and the CW (MOI *low* consequence of 5.2E-4 rem with corresponding Risk Class IV; CW *low* consequence of 0.071 rem with corresponding Risk Class IV).

In order to credit the filtered exhaust ventilation system for mitigation of the six drum fire, an acceptable facility configuration must be defined. The discussion under the risk

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dominant *Facility Fire Scenario 1 – 1 MW TRU Waste Drum Facility Fire* covers the necessary controls to define an acceptable facility configuration.

When the ***filtered exhaust ventilation system*** is credited for fire scenario mitigation, there is a possibility that the fire may impact the HEPA filters due to high air temperatures or hot embers and flying brands. Either of these impacts can result in the ignition of the filter stage, release of radioactive materials that were captured on the filter stage, and subsequent loss of filtration capability. However, the six drum fire scenario is not expected to challenge the filters due to elevated temperatures. It is also not expected that the six drum fire will have sufficient generation of hot embers and flying brands to challenge the filters due to hot particulates. For fires larger than the six drum fire, the ***automatic plenum deluge systems*** can provide protection for the HEPA filters against high temperatures and, to a lesser extent, against hot embers and flying brands. The systems consist of an automatic deluge feature that sprays into the plenum before the demister screen, a manually actuated deluge feature that bypasses the automatic deluge portion of the system and sprays before the demister screen, and a manually actuated deluge feature that sprays directly onto the filter stage. This latter feature directly wets the filters and may lead to stage failure due to water damage. Actuation of the direct filter spray manual deluge system has the potential to save the filters from burning at the expense of failing the filters due to wetting. Due to the low likelihood of the actuation or use of this system (large fires challenging the filters are not considered to be credible) and the potential for filter stage failure following use of the system, the ***automatic plenum deluge systems*** are not credited but serve as a defense-in-depth mitigative feature for protection against very large facility fires.

In summary, crediting the ***Building 991 filtered exhaust ventilation system*** and ***facility configuration*** controls would yield Risk Class IV results for the MOI and the CW.

Facility Fire Scenario 3 – Medium to Large Wooden LLW Crate Facility Fire

A facility fire is postulated to impact up to four wooden LLW crates. The facility fire is postulated to occur as a result of combustibles being ignited during the conduct of hot work, during the receipt or shipment of crates, or by exposure to electrical system components. The facility fire occurs in the West Dock Canopy Area. The facility fire is assumed to initially involve combustible materials located in close proximity to stored waste crates. The wooden crates become involved in the fire and combust along with their contents that are assumed to be combustible. The fire is limited to four wooden crates due to fire suppression by the automatic sprinkler system once the fire is sufficiently large to actuate the system.

The postulated facility fire involving four wooden LLW crates in the West Dock Canopy Area of the Building 991 Complex is considered to be an *unlikely* event with *low* consequences for the MOI, *moderate* consequences for the CW, and *low* consequences for the IW. The CW risk class is Risk Class II. The risk class for the MOI and the IW is Risk Class III, which is considered to be acceptable.

Acceptability of the risk class results for the CW is based on the conservatism of the analysis (*i.e.*, modeling input assumptions, defense-in-depth protective features not specifically credited). If a median χ/Q value and non-lofted plume is used in the analysis, the CW

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consequence is *low* (0.084 rem). If a lofted plume evaluation with 95th percentile χ/Q is performed, the CW consequence is *low* (0.024 rem). Either of these would lower the CW risk class to Risk Class III.

The analysis of the West Dock Canopy waste storage area fire assumes that a two or three wooden crate fire would not set off the automatic fire suppression system due to the high ceiling location. It is possible that the sprinkler system would actuate earlier and suppress the fire to a lower number of crates. A three LLW crate fire is just below the *low* consequence bin threshold value of 0.5 rem. If the impact of fire suppression yielded the equivalent of a two or three crate fire, the CW consequence result would be *low* and the corresponding risk class a Risk Class III.

Another conservatism deals with the event assumed MAR. Most of the wooden LLW crates to be stored in the West Dock Canopy Area come from the drum crushing operation or from the change out of HEPA filters in the complex. Both of these sources of LLW have historically had negligible contamination and LLW crates of these materials would be significantly (*i.e.*, orders of magnitude) less than 3 grams of radioactive material per crate. A reduction to approximately the 95th percentile of LLW crate MAR (*i.e.*, 0.7 grams) would reduce the CW consequences to *low* (0.16 rem) and the risk class to Risk Class III.

In summary, removal of analysis conservatism by using **more realistic MAR values** would yield Risk Class III results for the MOI, the CW, and the IW.

Spill Scenario 1 – TRU Waste Drums Drop/Fall

A spill is postulated to occur as a result of breaching up to four 55-gallon TRU waste drums containing radioactive material. The breach of the drums may occur as a result of the drums being raised on a forklift and falling from that position, or as a result of being stacked on the third or fourth tier and then being impacted by material handling equipment during operations being conducted in the facility. Upon impact with the hard surface, the drums are damaged and opened, and the waste packages in the drums are breached by the weight of the waste packages and the force of the impact. Due to stacking configurations, this scenario is postulated to occur in those areas where stacking above the second tier may occur. These areas include Room 134 (4-high), Room 140/141 (3-high), Room 143 (3-high), Room 151 (3-high), Room 166 (4-high), or Room 170 (4-high).

The postulated spill of a pallet of TRU waste drums in the Building 991 Complex is considered to be an *anticipated* event with *low* consequences to the MOI and IW, and an *anticipated* event with *moderate* consequences to the CW. The risk classes for the MOI and IW are Risk Class III, which is considered to be acceptable. The risk class for the CW is Risk Class I.

Portions of the waste storage areas for the Building 991 Complex have filtered exhaust ventilation. Specifically, the north waste storage areas and the Building 996 waste storage area are ventilated. The south waste storage areas (excluding Room 166), while not directly supported by a filtered exhaust ventilation system, have sufficient negative differential pressure

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with respect to atmosphere under certain configurations to credit the filtration provided by the north waste storage area ventilation system. The north and most south waste storage areas have the potential to exhaust through a single stage of HEPA filtration. Building 996 and Building 998 are potentially exhausted through two stages of HEPA filtration (*i.e.*, Building 996 through two stages in Building 985 and Building 998 through a single, Building 998 dedicated stage and a single stage in the Building 991 filter plenum) but spills are not expected in these areas since there is no stacking above two tiers. Crediting a single tested stage filter efficiency of 0.999 would reduce the risk class for the CW by two levels (CW *low* consequence of 3.1E-3 rem with corresponding Risk Class III).

In order to credit the filtered exhaust ventilation system for mitigation of the waste container spill, an acceptable facility configuration must be defined. The Building 991 exhaust ventilation system can support mitigation of accident scenarios in all interior container storage/staging areas except for Room 166. An operations restriction to permit ***only POCs to be stored in Room 166*** is imposed to reduce concerns dealing with exterior natural gas lines located outside of Room 166. This same control shall be used to negate concerns about a lack of a ventilation system supporting Room 166 for the mitigation of a waste container spill since POCs are not vulnerable to spills from heights less than 30 feet.

As stated above, the ***Building 991 filtered exhaust ventilation system*** supports all other areas. The north waste storage areas are directly supported by this system. Building 996 and Corridor B are normally supported by the Building 985 filtered exhaust ventilation system, but the Building 991 system can cover these areas if the Building 985 system is not being used. However, if the Building 985 exhaust ventilation system is used to support personnel access to the tunnel and vault areas, a ***stage of tested HEPA filtration in Building 985*** is required. The tested stage is used to mitigate spills in the Building 996 waste container storage areas and to mitigate some spills in the Building 991 container storage/staging areas (*i.e.*, some areas of Building 991 are ventilated by Building 985 due to competitive suction between the two ventilation systems) for spills occurring while the Building 985 system is operating.

The south waste container storage areas, other than Room 166, are supported by the ***Building 991 filtered exhaust ventilation system*** under certain facility configurations. The ***facility configuration*** controls considered to be acceptable for providing an airflow connection from the south areas to the north areas of Building 991 are presented in the discussion under risk dominant *Facility Fire Scenario 1 – 1 MW TRU Waste Drum Facility Fire.*

If the Room 170 dock doors are open, an airflow through the dock doors into Room 170 may exist but no credit is taken for exhaust filtration in Room 170 while the doors are open. That is, accident scenarios in Room 147 and 170 occurring when Room 170 dock doors are open are unmitigated. In order to ensure that spills in Room 170 are mitigated, a control to restrict operations in Rooms 147 and 170 when the dock doors are open is required. However, the dock doors must be open during receiving and shipping operations in Room 170.

Receipt and shipment operations in Room 170 are defined as follows:

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- Movement of waste containers from a transport vehicle at the dock to a staging area in Room 170.
- Movement of waste containers from a staging area in Room 170 to a transport vehicle at the dock.
- Movement of SNM Type B shipping containers from a transport vehicle at the dock to a vault staging location in the north area of the facility.
- Movement of SNM Type B shipping containers from a vault staging location in the north area of the facility to a transport vehicle at the dock.

All other container movement within Room 170 or from/to Room 170 are not considered to be part of receipt and shipment operations.

A control to ***restrict all operations, other than receipt and shipment, in Rooms 147 and 170 when dock doors are open*** along with a control to ***restrict waste container stacking above a second tier during receipt and shipment*** are imposed to reduce the likelihood of spill scenarios in the area while the dock doors are open. Since all waste containers permitted in the facility are qualified to survive falls of four feet or less (Type B shipping containers and POCs are qualified to 30 feet), restricting stacking above a second tier ensures that containers are not lifted above four feet. Therefore, it is postulated that container spill scenarios occurring during the conduct of receiving or shipping operations are precluded. If the operations restrictions are imposed, all facility container operations-induced spills can be analyzed crediting a stage of HEPA filtration.

Another conservatism deals with the event likelihood. Failure of the ***metal waste containers*** resulting in a release of radioactive material could be argued to be an *unlikely* event. Even though there have been incidents where containers were dropped or fell in the past, the majority of past events have been of relatively low energy, typically resulting in the denting of containers with no loss of containment. If this scenario conservatism were removed, the risk class for the CW would be reduced by one level but the risk classes for the MOI and IW would remain the same.

In summary, crediting the ***Building 991 filtered exhaust ventilation system*** and ***facility configuration*** controls would yield Risk Class III results for the CW.

Puncture Scenario 1 – LLW, TRU, POC, and Type B Container Punctures (Case B)

A radioactive material spill is postulated to occur as a result of puncturing a TRU waste container. The puncture of the container may occur as a result of the container being impacted and punctured by material handling equipment while loading, unloading, and/or transferring the container from its receipt/shipment area to its storage/staging area. The puncture may occur in all storage/staging areas in the building as well as the dock areas during receipt/shipment operations. The forklift error results in a puncture, by the forklift tines, of two adjacent TRU waste drums located on a pallet. A fraction of the contents of the punctured waste containers are postulated to "flow" through the breach onto the ground/floor.

The postulated puncture of two TRU drums (Case B) on a pallet in the Building 991 Complex is considered to be an *unlikely* event with *low* consequences to the MOI and IW, and *moderate* consequences to the CW. The risk classes for the MOI and IW are Risk Class III, which is considered to be acceptable. The risk class for the CW is Risk Class II.

Acceptability of the risk class results for the CW in Case B, in part, is based on the conservatism of the analysis (*i.e.*, modeling input assumptions, defense-in-depth protective features not specifically credited). In the analysis of Case B it was assumed that a forklift would penetrate two TRU drums on a pallet during the event. The scenario also applied a conservative DR of 10%. If it is assumed that the forklift would only penetrate one TRU drum during the event, the CW consequence would be reduced by half (3.1 rem) and the scenario risk class would remain Risk Class III.

Portions of the waste storage areas for the Building 991 Complex have filtered exhaust ventilation. Specifically, the north waste storage areas and the Building 996 waste storage area are ventilated. The south waste storage areas (excluding Room 166), while not directly supported by a filtered exhaust ventilation system, have sufficient negative differential pressure with respect to atmosphere under certain configurations to credit the filtration provided by the north waste storage area ventilation system. The north and most south waste storage areas have the potential to exhaust through a single stage of HEPA filtration. Building 996 and Building 998 are potentially exhausted through two stages of HEPA filtration (*i.e.*, Building 996 through two stages in Building 985 and Building 998 through a single, Building 998 dedicated stage and a single stage in the Building 991 filter plenum). Crediting a single tested stage filter efficiency of 0.999 would reduce the risk class for the CW for Case B (CW *low* consequence of 6.2E-3 rem with corresponding Risk Class III).

In order to credit the filtered exhaust ventilation system for mitigation of the TRU waste drum puncture, an acceptable facility configuration must be defined. The discussion under the risk dominant *Facility Fire Scenario 1 – 1 MW TRU Waste Drum Facility Fire* covers the necessary controls to define an acceptable facility configuration for most situations. However, TRU waste drum puncture events can occur when the Room 170 dock doors are open during receipt and shipment operations (all other operations in Room 147 and 170 require that the dock doors be closed). While significant inflow of air through the dock doors is expected when the doors are open and transport vehicles are parked against the dock, it is conservatively assumed that the radioactive material releases from container puncture events at the dock, with dock doors open, are not mitigated by HEPA filtration.

TRU waste drum exposures to forklift tines can occur during any container movement. Container movements in areas other than Room 147 and 170 are mitigated by the ***Building 991 filtered exhaust ventilation system***. Container movements in Rooms 147 and 170 while dock doors are closed are also mitigated by the system. Container movements during receipt and shipment activities, when the dock doors are open, are assumed to not be mitigated by the ventilation system. Therefore, more than half of the container movements will be mitigated.

The risk and consequences of Puncture Scenario 1 (Case B) will be presented for two situations: 1) Case B1 (unmitigated) represents punctures occurring in Room 147 or 170 while dock doors are open; and 2) Case B2 (mitigated) represents punctures occurring at any other time.

In summary, removal of analysis conservatism by assuming that only one TRU drum is involved in the puncture event would continue to yield Risk Class II results for the CW for Case B1 (*unlikely* frequency, *moderate* consequences). No credit is taken in Case B1 for the expected inflow of air while dock doors are open that would tend to mitigate the puncture scenario consequences. Crediting the ***Building 991 filtered exhaust ventilation system*** and ***facility configuration*** controls would reduce the CW risk to Risk Class III for Case B2 (*unlikely* frequency, *low* consequences).

Container Explosion Scenario 1 – TRU Waste Box Container Explosion

Hydrogen generation in metal waste containers is postulated to lead to an internal hydrogen explosion in a TRU waste container. The radioactive decay of the TRU waste material interacts with hydrogenous waste materials and produces hydrogen and oxygen gases. The gases are retained in the metal waste container and allowed to accumulate to the point where a hydrogen explosion potential exists. Since as little energy as is associated with a static charge can ignite flammable hydrogen/oxygen mixtures, static charges generated by container movements ignite the hydrogen. Therefore, the container explosion can occur at any point in the handling of the container (*i.e.*, at the storage location, at the dock, and during transit). Since the container loses its lid as part of the scenario, the material impacted by the event is no longer confined. The scenario deals with an overpressure event that is conservatively assumed to impact radioactive material in the form of a powder.

The postulated TRU waste box container explosion in the Building 991 Complex is considered to be an ***extremely unlikely*** event with ***moderate*** consequences for the MOI, ***high*** consequences for the CW, and ***moderate*** consequences for the IW. The CW risk class is Risk Class II. The risk classes for the MOI and the IW are Risk Class III, which are considered to be acceptable.

Acceptability of the risk class results for the CW, in part, is based on the conservatism of the analysis (*i.e.*, modeling input assumptions, defense-in-depth protective features not specifically credited). The rationale that the analysis of a waste box is a conservatism is as follows: (1) TRU waste boxes have not been the focus of hydrogen explosion issues at the Site; (2) it is not clear that a TRU waste box has the potential to be involved in an internal hydrogen explosion due to less radioactive material per unit volume, the type of wastes associated with TRU waste boxes, and the significantly larger head space area; and (3) there are far fewer TRU waste boxes than TRU waste drums, which makes the scenario less likely to occur in a TRU waste box.

Also, there is conservatism in using the non-combustible contaminated solid release fraction values from the DOE Handbook. These values are meant to be applied to rigid, non-yielding contaminated surfaces where the venting gases can act against the rigid surface.

Wastes of this type (*e.g.*, contaminated metals) are less likely to generate hydrogen by radiolysis than combustible wastes (*e.g.*, contaminated paper, contaminated plastic). The wastes more likely to generate hydrogen would have a DOE Handbook ARF value of 0.001 and a RF value of 1.0. If these values are used in combination with 95th percentile χ/Q values and a TRU waste drum inventory, the CW consequences remain *high* (31 rem) and the risk class remains Risk Class II. In this case the MOI consequences become *low* (0.023 rem) and the risk class reduces to Risk Class IV.

Portions of the waste storage areas for the Building 991 Complex have filtered exhaust ventilation. Specifically, the north waste storage areas and the Building 996 waste storage area are ventilated. The south waste storage areas (excluding Room 166), while not directly supported by a filtered exhaust ventilation system, have sufficient negative differential pressure with respect to atmosphere under certain configurations to credit the filtration provided by the north waste storage area ventilation system. The north and most south waste storage areas have the potential to exhaust through a single stage of HEPA filtration. Building 996 and Building 998 are potentially exhausted through two stages of HEPA filtration (*i.e.*, Building 996 through two stages in Building 985 and Building 998 through a single, Building 998 dedicated stage and a single stage in the Building 991 filter plenum). Crediting a single tested stage filter efficiency of 0.999 would reduce the risk class for the CW (CW *low* consequence of 0.35 rem with corresponding Risk Class IV; note that the MOI risk class would also be reduced from Risk Class III to Risk Class IV).

In order to credit the filtered exhaust ventilation system for mitigation of the TRU waste container explosion, an acceptable facility configuration must be defined. The discussion under the risk dominant *Facility Fire Scenario 1 – 1 MW TRU Waste Drum Facility Fire* covers the necessary controls to define an acceptable facility configuration for most situations. However, TRU waste container explosion events can occur when the Room 170 dock doors are open during receipt and shipment operations (all other operations in Room 147 and 170 require that the dock doors be closed). While significant inflow of air through the dock doors is expected when the doors are open and transport vehicles are parked against the dock, it is conservatively assumed that the radioactive material releases from container explosion events at the dock, with dock doors open, are not mitigated by HEPA filtration.

TRU waste container exposures to static charges can occur during any container movement. Container movements in areas other than Room 147 and 170 are mitigated by the ***Building 991 filtered exhaust ventilation system***. Container movements in Rooms 147 and 170 while dock doors are closed are also mitigated by the system. Container movements during receipt and shipment activities, when the dock doors are open, are assumed to not be mitigated by the ventilation system. Therefore, more than half of the container movements will be mitigated.

The risk and consequences of Container Explosion Scenario 1 will be presented for two situations: 1) Case 1 (unmitigated) represents container explosions occurring in Room 147 or 170 while dock doors are open; and 2) Case 2 (mitigated) represents container explosions occurring at any other time.

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In summary, removal of analysis conservatism by **using a TRU waste drum versus a TRU waste box** and **using more appropriate ARF and RF values** would continue to yield Risk Class II result for the CW. No credit is taken in Case 1 for the expected inflow of air while dock doors are open that would tend to mitigate the container explosion scenario consequences. Crediting the ***Building 991 filtered exhaust ventilation system*** and ***facility configuration*** controls would reduce the MOI and CW risk to Risk Class IV for Case 2 (*extremely unlikely* frequency, *low* consequences).

NPH/EE Scenario 1 – DBE Event-Induced Spill

A DBE event is postulated to occur impacting the POC and TRU waste storage areas in the Building 991 Complex. TRU waste containers stored in Building 991 are considered to be susceptible to earthquake impacts. Containers that are impacted may be breached by falling debris (e.g., overhead cranes; heating, ventilating, and air conditioning (HVAC) ducts; etc.) and other overhead equipment that is not seismically rated. The building structure and roof is expected to remain intact in a DBE event and stacked waste containers are not expected to topple in a DBE event. The exposed upper tier of waste containers is assumed to be susceptible to impact from the falling debris. The breached containers from the falling debris do not spill the container contents from the breach since the breach is at the top or upper portion of the container.

The postulated DBE scenario is considered to be an *unlikely* event with *high* consequences for the CW, *moderate* consequences for the MOI, and *moderate* consequences for the IW. The MOI and the IW risk class for the scenario is Risk Class II. The CW has Risk Class I scenario results.

Acceptability of the risk class results for the CW and the MOI is based on the conservatism that is assumed in the analysis. If a median χ/Q value (approximately an order of magnitude reduction in atmospheric dispersion) were used in the analysis, the CW consequences would be *moderate* and the MOI consequences would be *low*. This would yield a reduction in the corresponding risk class for the CW and MOI. Use of a more realistic MAR (*i.e.*, a factor of 2 reduction in MAR) concurrent with a median χ/Q value yields the same results.

The DBE scenario does not take any credit for deposition and building retention of radioactive material that is released during the event. If the ventilation system is not functioning, the ambient building leakpath factor is qualitatively judged to be less than 0.1 for an intact facility. In the DBE event the building is assumed to remain intact. Assuming an ambient building leakpath factor of 0.1 reduces the MOI consequences to *low* and the CW consequences to *moderate*. This reduces the risk class to the MOI to Risk Class III and to the CW to Risk Class II.

The damage ratios used in the analysis and the drum loading of the facility that is assumed are both conservative. However, an order of magnitude conservatism from each of these analysis assumptions is not likely. The combined effect of the two assumptions could result in an order of magnitude conservatism that, if removed, would lower the risk class for the MOI and for the CW.

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The immediate worker analysis is insensitive to analysis assumptions or credited controls due to the impact of the earthquake on the facility and the corresponding *moderate* radiological consequences to the immediate worker as a result of the falling debris incapacitating the IW. The level of earthquake that is postulated would have similar effects on workers in most other buildings, on or off the Site.

In summary, removal of analysis conservatism by using **median weather** and **using a more realistic MAR** (i.e., a factor of 2 reduction in MAR) would yield Risk Class III results for the MOI and Risk Class II results for the CW. The risk to the IW remains as Risk Class II since an IW may be trapped by falling debris.

Summary of Risk Dominant Accident Scenarios

Once analysis conservatism was removed, three of the dominant accident scenario cases remained high risk scenarios for at least one receptor. The puncture of one (originally two) TRU waste container yielded a CW Risk Class II scenario (*unlikely* frequency, *moderate* consequences); the container explosion accident scenario yielded a CW Risk Class II scenario (*extremely unlikely* frequency, *high* consequences); and the DBE event-induced spill accident scenario yielded a CW Risk Class II scenario (*unlikely* frequency, *moderate* consequences) and IW Risk Class II scenario (*unlikely* frequency, *moderate* consequences) following removal of some analysis conservatism and crediting of a single tested stage of HEPA filtration in many cases.

Consequences can be mitigated by HEPA filtration in many accident scenarios as long as the event occurs inside the facility in ventilated areas. Given that most waste containers are stored in directly ventilated areas (*i.e.*, north waste storage/staging areas) or in indirectly ventilated areas (*i.e.*, Rooms 134, 135, 147, and 170), the reduction in scenario consequences by HEPA filtration can be credited for some of the scenarios but the dominant scenario cases would be at the dock when dock doors are open. The credited HEPA filtration control is included in the TSRs as a Limiting Condition for Operation (LCO). Raising this control to a fully credited feature changes the risk class conclusions.

The risk from accident scenarios that were not risk dominant scenarios (*i.e.*, *low* risk scenarios; Risk Class III or IV for all receptors) can be lowered, in many cases, as a result of the crediting of a single tested stage of HEPA filtration for mitigation of risk dominant accident scenarios. Some other risk reduction measures that may not be necessary from a nuclear safety perspective, should be included, where possible. Examples include: (1) use of flammable gas cylinders with capacities or loaded to levels that are limited to a level necessary for the maintenance activity being performed and (2) preferential storage of POC containers rather than TRU waste containers in indirectly ventilated areas (*i.e.*, south waste container storage areas).

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Table 4-6 Risk Dominant Accident Scenarios

RISK DOMINANT ACCIDENT SCENARIO	ANALYZED RISK CLASS[1]			ADDITIONAL CONSIDERATIONS FOR RISK REDUCTION[1]			RISK REDUCTION REMARKS
	MOI	CW	IW	MOI	CW	IW	
Facility Fire Scenario 1 – 1 MW TRU Waste Drum Facility Fire Facility fire involving up to 3 TRU waste drums.	Unlikely Moderate 0.26 $\boxed{\text{II}}$	Unlikely High 35 $\boxed{\text{I}}$	Unlikely Low N/A III	Unlikely Low 2.6E-4 III	Unlikely Low 0.035 III	N/A	Consequences reduced crediting a single stage of tested HEPA filtration.
Facility Fire Scenario 2 – 2 MW TRU Waste Drum Facility Fire Facility fire involving up to 6 TRU waste drums.	Extremely Unlikely Moderate 0.52 III	Extremely Unlikely High 71 $\boxed{\text{II}}$	Extremely Unlikely Low N/A IV	Extremely Unlikely Low 5.2E-4 IV	Extremely Unlikely Low 0.071 IV	N/A	Consequences reduced crediting a single stage of tested HEPA filtration.
Facility Fire Scenario 3 - Medium to Large Wooden LLW Crate Facility Fire Facility fire involving up to 4 wooden LLW crates.	Unlikely Low 0.0048 III	Unlikely Moderate 0.66 $\boxed{\text{II}}$	Unlikely Low N/A III	N/A	Unlikely Low 0.16 III	N/A	Consequences reduced assuming more realistic MAR values.

Table 4-6 Risk Dominant Accident Scenarios

RISK DOMINANT ACCIDENT SCENARIO	ANALYZED RISK CLASS[1]			ADDITIONAL CONSIDERATIONS FOR RISK REDUCTION[3]			RISK REDUCTION REMARKS
	MOI	CW	IW	MOI	CW	IW	
Spill Scenario 1 - TRU Waste Drums Drop/Fall Spill involving a pallet of 55-gallon TRU waste drums.	Anticipated Low 0.023 III	Anticipated Moderate 3.1 $\boxed{\text{I}}$	Anticipated Low N/A III	N/A	Anticipated Low 3.1E-3 III	N/A	Consequences reduced crediting a single stage of tested HEPA filtration.
Puncture Scenario 1 - LLW, TRU, POC, and Type B Container Punctures Case B1: Puncture of 2 TRU waste drums during handling at dock while dock doors are open.	Unlikely Low 0.046 III	Unlikely Moderate 6.2 $\boxed{\text{II}}$	Unlikely Low N/A III	N/A	Unlikely Moderate 3.1 $\boxed{\text{II}}$	N/A	Consequences reduced assuming puncture only involves a single TRU waste drum, rather than two drums, but consequences remained in *moderate* bin.
Puncture Scenario 1 - LLW, TRU, POC, and Type B Container Punctures Case B2: Puncture of 2 TRU waste drums during handling while dock doors are closed.	Unlikely Low 0.046 III	Unlikely Moderate 6.2 $\boxed{\text{II}}$	Unlikely Low N/A III	N/A	Unlikely Low 6.2E-3 III	N/A	Consequences reduced crediting a single stage of tested HEPA filtration.

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Table 4-6 Risk Dominant Accident Scenarios

RISK DOMINANT ACCIDENT SCENARIO	ANALYZED RISK CLASS[1]			ADDITIONAL CONSIDERATIONS FOR RISK REDUCTION[1]			RISK REDUCTION REMARKS
	MOI	CW	IW	MOI	CW	IW	
Container Explosion Scenario 1 - TRU Waste Box Container Explosion Case 1: Container explosion involving a single TRU waste box during handling at dock while dock doors are open.	Extremely Unlikely Moderate 2.6 III	Extremely Unlikely High 350 $\boxed{II}$	Extremely Unlikely Moderate N/A III	N/A	Extremely Unlikely High 31 $\boxed{II}$	N/A	Consequences reduced assuming more appropriate ARF and RF values and assuming TRU waste drum (versus TRU waste box).
Container Explosion Scenario 1 - TRU Waste Box Container Explosion Case 2: Container explosion involving a single TRU waste box during handling while dock doors are closed.	Extremely Unlikely Moderate 2.6 III	Extremely Unlikely High 350 $\boxed{II}$	Extremely Unlikely Moderate N/A III	N/A	Extremely Unlikely Low 0.35 IV	N/A	Consequences reduced crediting a single stage of tested HEPA filtration, but conservatism of analysis MAR, ARF, and RF values maintained (see Case 1).
NPH/EE Scenario 1 – DBE Event-Induced Spill DBE event causes overhead equipment to fall and breach TRU waste drums.	Unlikely Moderate 0.35 $\boxed{II}$	Unlikely High 48 $\boxed{I}$	Unlikely Moderate N/A $\boxed{II}$	Unlikely Low 0.018 III	Unlikely Moderate 3.0 $\boxed{II}$	Unlikely Moderate N/A $\boxed{II}$	Consequences reduced assuming median χ/Q values & more realistic MAR; CW consequences dropped to *moderate* bin; IW consequences remain unchanged.

[1] First value is frequency bin; second value is radiological dose consequence bin; third value is consequences in rem; fourth value is assigned risk class based upon frequency and consequences.

4.7 SAFETY MANAGEMENT PROGRAM ATTRIBUTES

Table 4-7 provides the attributes of the listed SMPs that were identified in the safety analysis of the Building 991 Complex FSAR. These attributes of the SMPs establish the SMP functional or performance objectives that are most important to the safety of the facility. The safety analysis was performed under the assumption that these attributes were implemented in the facility. In particular, protection of the immediate worker relies on the implementation of many of these attributes.

Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Organization and Management	The Organization and Management SMP provides the infrastructure to implement and maintain the TSR controls—Limiting Conditions for Operation (LCOs), Surveillance Requirements (SRs), Administrative Controls (ACs), and Design Features—so that the Building 991 Complex will be operated within its authorization basis. Specific attributes of the Organization and Management program identified in the safety analysis are:	Organizational structure and facility management is necessary to ensure that the controls identified in the TSRs are fully implemented and maintained. Specification of controls without an infrastructure to assure implementation and maintenance of the controls is of limited value.
	1. Limited quantities of hazardous chemicals are present in the Building 991 Complex.	1. The hazard evaluation credited the current limited inventory of hazardous chemicals in the facility to eliminate analysis of chemical hazards to the collocated worker (CW) or public.
	2. The Building 991 Complex Facility Manager is notified by the President of the Site (KH) if the Fire Department does not have adequate staffing.	2. The Fire Department serves a defense-in-depth protection function in mitigating fires in the facility. The Fire Department also serves to mitigate facility flooding and water damage due to actuation of the Automatic Sprinkler System. The loss of this function tends to increase the likelihood of large fires in the fire analysis.
Configuration Management	The Configuration Management program ensures that System Category (SC)-1/2 and SC-3 structures, systems, and components (SSCs) (including Design Features) are subject to configuration change control. The specific attribute of the Configuration Management program identified in the safety analysis is:	The safety analysis of the FSAR makes assumptions about the configuration and operation of SC-1/2 and SC-3 SSCs. The configuration of this equipment is maintained to ensure that FSAR assumptions are valid. The hazard evaluation of the Building 991 Complex assumes that the current configuration of identified hazard/energy sources (13.8 kV transformers, heated water, electric heaters, diesel generator including day tank and batteries, compressed air compressors, drum crusher, rotating machinery, overhead cranes, battery charging station, diesel fuel storage tank combustibles, X-ray device, and general industrial chemicals) is maintained to ensure that hazards: (a) remain separated from hazardous material; (b) remain remote from CW and public; (c) remain relatively low temperature; (d) remain relatively low pressure; and (e) remain separate from radioactive material.

Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Configuration Management (continued)	1. Safety and technical review and validation of design modification work on or potentially impacting SC-1/2 and SC-3 SSCs is performed before approval and implementation of the design.	1. The safety and technical review process for design modifications on or potentially impacting SC-1/2 and SC-3 SSCs ensures that the SSCs will continue to perform their credited and/or intended functions after modification of equipment in the Building 991 Complex. This maintains the facility safety basis even though SC-1/2 and SC-3 SSC-impacting modifications are planned.
Emergency Response	An Emergency Response program ensures that a formalized emergency response capability is maintained. Specific attributes of the Emergency Response program identified in the safety analysis include:	Emergency response actions mitigate the consequences of accidents that occur in the facility, particularly for immediate workers.
	1. An approved facility emergency plan is in place.	1. Assessment of immediate worker consequences for facility fires, spills, punctures, container explosions, and other events consistently assumes worker evacuation from the scene. The facility emergency plan identifies worker response to these types of events. The facility emergency plan also identifies personnel response to a seismic event and severe weather (high winds, snow, flooding, tornado, etc.). Periodic drills are specified in the facility emergency plan to ensure personnel are aware of the proper response to an emergency event.
	2. Emergency response personnel are identified and trained.	2. Authorized personnel using approved instructions to respond to and minimize the spread of radiological/hazardous material resulting from facility fires, spills, punctures, container explosions, and other events reduces the consequences associated with releases.

Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Environmental Protection and Waste Management	An Environmental Protection and Waste Management program ensures that environmental protection and waste management controls are implemented. Specific attributes of the Environmental Protection and Waste Management program identified in the safety analysis include:	In many cases, by meeting the requirements for environmental protection imposed by regulatory agencies, protection is provided to the public and workers. This program was specifically identified in the hazard evaluation in two assumptions. The first assumption was that container opening was prohibited as specified in AC 5.2. The second assumption was that the current configuration of hazard/energy sources (heated water, electric heaters, diesel generator including day tank and batteries, compressed air compressors, drum crusher, rotating machinery, overhead cranes, general industrial chemicals, battery charging station, and diesel fuel storage tank combustibles) is maintained to ensure that hazards (a) remain separate from hazardous materials and (b) remain exposed to limited radioactive material. The Environmental Protection and Waste Management program is indirectly identified in multiple postulated accident scenario controls. The postulated accident scenarios include facility fire, spills, punctures, container explosions, facility explosions, and criticalities. The specific controls identified that require this program include: (1) container radioactive material loading; (2) pipe overpack containers (POCs); (3) metal waste containers; (4) waste container vents; (5) wooden waste containers; (6) Type B shipping container stacking restrictions; (7) wooden waste crate liners; (8) prohibiting storage of waste containers in Corridor C; and (9) prohibition of liquids in waste.
	1. A current documented inventory of waste is maintained.	1. A facility waste inventory is important in the maintenance of several ACs. Verification of waste container Item Description Code (IDC) and fissile material loading can be performed.
	2. The facility operates the Resource Conservation and Recovery Act (RCRA) satellite storage area in accordance with regulations.	2. The Building 991 Complex does not currently contain a RCRA storage area but does have a RCRA satellite storage area for the accumulation of nickel-cadmium batteries. Regulations associated with the satellite storage area will be followed to ensure environmental protection.

Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Environmental Protection and Waste Management (continued)	3. Waste generated in the facility is managed in accordance with appropriate regulations. 4. Toxic Substances Control Act (TSCA) regulated substances are controlled.	3. Significant restrictions are placed on waste containers received by the facility under AC 5.2. While the facility is not expected to generate extensive waste, waste containers, waste forms, and container contents for facility generated waste will be compliant with any appropriate regulations to ensure protection of the public, the workers, and the environment. 4. The Building 991 Complex currently is permitted to store TSCA waste (polychlorinated biphenyl (PCB) contaminated waste). Regulations associated with the TSCA waste storage will be followed to ensure environmental protection and to maintain the low consequence level assigned to this waste by the safety analysis.
Fire Protection	A Fire Protection program ensures that fire protection controls are implemented. Specific attributes of the Fire Protection program identified in the safety analysis include: 1. A Building 991 Complex specific combustible control program to define acceptable combustible material area loading and a process to remediate any areas found to contain excessive combustible material loading is in place.	The safety analysis places great importance on a combustible material control program to ensure that large fires do not occur in waste container storage areas. Postulated accident scenarios that specify the Fire Protection program include facility fire, facility explosions, and criticalities. 1. Determination of acceptable combustible material loading in various areas and maintaining the facility in compliance with the determination are key elements of the control of combustibles in the facility. Specific controls in the combustible control program include: (1) flammable gas restrictions in vaults with SNM; (2) flammable gases restrictions near waste containers as identified in AC 5.3; (3) restrictions on high heat release rate combustible materials as identified in AC 5.3; (4) restrictions on combustible loading as identified in AC 5.3; (5) restrictions on combustible material location as identified in AC 5.3; (6) restrictions on ignition sources as identified in AC 5.3; and (7) restrictions on the introduction of acetylene into areas where radiological materials would be impacted as identified in AC 5.3.

Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Fire Protection (continued)	2. Spark, heat, or flame-producing work is conducted in accordance with *Health and Safety Practices Manual* procedure 1-W13-HSP-31.10, *Hot Work* (Ref. 23).	2. An ignition source control program accommodates changes occurring in the facility (maintenance, decommissioning, equipment removal, etc.). These changes may require ignition sources (spark/heat/flame producing work) as part of the work package. In order to ensure that ignition sources are controlled in the facility, given the transient nature of many ignition sources, work involving spark/heat/flame producing work will be controlled. This control can take the form of a hot work permit process.
	3. Fire watches are implemented in accordance with *Health and Safety Practices Manual* procedure PRO-V60-HSP-34.06, *Compensatory Measures and Fire Watches* (Ref. 24).	3. LCO 3.1 requires implementation of fire watches during conditions when the Automatic Sprinkler System and Flow Alarm Transmittal System is not operable. In order to ensure that fire watches are controlled in the facility, the fire watch will be established in accordance with Site requirements.
	4. The Fire Department responds to fires in the Building 991 Complex.	4. The Fire Department serves a defense-in-depth protection function in mitigating fires in the facility. The Fire Department also serves to mitigate facility flooding and water damage due to actuation of the Automatic Sprinkler System. The loss of this function tends to increase the likelihood of large fires in the fire analysis.
<u>Safety and Industrial Hygiene</u>	A Safety and Industrial Hygiene program provides for worker protection from physical, biological and chemical hazards associated with work conducted in the facility. Specific attributes of the Safety and Industrial Hygiene program identified in the safety analysis include:	Much of the immediate worker protection from standard industrial hazards is provided by controls developed under the Safety and Industrial Hygiene Program.
	1. Physical, biological and chemical hazards are identified and assessed.	1. In order to develop an appropriate set of controls, the physical, biological, and chemical hazards encountered in the facility will be known. Therefore, a process to identify physical, biological, and chemical hazards to the worker is needed.
	2. Appropriate controls for identified physical, biological and chemical hazards are established.	2. As physical, biological, and chemical hazards are identified, appropriate controls to protect the worker will be identified. This provides worker safety against physical, biological, and chemical hazards in the Building 991 Complex.

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Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Safety and Industrial Hygiene (continued)	3. Sealed sources are contained in a non-dispersible form.	3. The hazard evaluation assumed that sealed sources are non-dispersible which eliminated further evaluation of these potential hazards.
	4. Chemicals in the Building 991 Complex are packaged in accordance with Site packaging requirements.	4. The hazard evaluation assumed that chemicals in the Building 991 Complex meet Site packaging requirements.
	5. Limited quantities of hazardous chemicals are present in the Building 991 Complex.	5. The hazard evaluation credited the current limited inventory of hazardous chemicals in the facility to eliminate analysis of chemical hazards to the CW or public.
Maintenance	A Maintenance program controls maintenance activities. The specific attributes of the Maintenance program identified in the safety analysis include:	The safety analysis of the FSAR makes assumptions about the availability of SC-1/2 and SC-3 SSCs. This equipment is maintained to ensure that the safety functions of the SSC are available. LCO 3.1 and AC 5.4 detail the safety functions of the SC-1/2 and SC-3 SSCs required from the accident analysis.
	1. Safety and technical review and approval of maintenance work packages on or potentially impacting SC-1/2 and SC-3 SSCs is performed.	1. The safety and technical review process for maintenance work packages on or potentially impacting SC-1/2 and SC-3 SSCs ensures that the SC-1/2 and SC-3 SSCs will continue to perform their credited and/or intended functions after maintenance of equipment in the Building 991 Complex. This maintains the facility safety basis even though SC-1/2 and SC-3 SSC-impacting maintenance work is planned.
	2. Preventive maintenance requirements to protect the function(s) provided by SC-1/2 and SC-3 SSCs (includes Design Features) are assessed and established.	2. SC-1/2 and SC-3 SSC failure may be unacceptable from a risk standpoint or from facility availability considerations. The choice between allowing SC-1/2 and SC-3 SSCs to degrade over time until failure versus performing preventive maintenance on the equipment will be made by facility management. The choice should not be made without an understanding of the alternatives. The process to assess the need for preventive maintenance provides facility management with the needed information.

Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Quality Assurance	A QA program controls the Building 991 Complex Quality Assurance. Specific attributes of the QA program relied on in the safety analysis include: 1. Non-conforming items are controlled. 2. Requirements for procured items and services affecting SC-1/2 SSCs are established.	QA is a fundamental assumption of the safety analysis. The assumptions dealing with the facility configuration and operation should be consistent with the QA program. 1. Non-conforming items can include non-compliant waste containers or SNM containers. The ACs specify segregation of non-conforming items in many cases. These items will be controlled until removed from the facility to ensure that they are not re-entered in the inventory or that a new non-compliant condition is not entered. 2. Due to the importance of SC-1/2 SSCs in protecting the public and CW, the reliability / availability of a SC-1/2 SSC should be high. Verification of procured items and services related to the SC-1/2 SSC provides high reliability / availability of the SC-1/2 SSC. Determination of acceptance criteria for the items and services is necessary in order that the corresponding high reliability / availability is realized.
Training	A Training program ensures that trained personnel perform work. A attribute of the Training program relied on in the safety analysis is: 1. A summary of personnel qualification and certification requirements (*e.g.*, Training Implementation Matrix) is developed and maintained with emphasis on the following elements: Authorization Basis Compliance, Area-Specific Training, Job-Specific Training, and Emergency Response Training.	Personnel performing work in the facility have the potential to negatively impact facility safety through errors of omission (not doing something) or commission (doing something not allowed or expected). One means of reducing these types of errors is to train the personnel performing the work. 1. Different work in the facility requires different types of expertise and training. The development and maintenance of the personnel qualifications and certifications needed to perform various tasks ensures that training requirements are defined for each activity in the facility.

Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Transportation	A Transportation program controls facility radioactive and hazardous materials transportation, shipping, and receiving. Specific attributes of the Transportation program identified in the safety analysis include: 1. Visual inspections, which focus on identifying degradation of waste container integrity (*e.g.*, indentations, punctures), are performed on all waste containers upon receipt at the dock area and prior to staging for shipment from the dock area. 2. On-site and off-site transportation requirements are identified and these requirements are implemented for waste and SNM containers.	The Building 991 Complex serves as a holding point for waste containers and SNM containers and relies heavily on container strength and integrity driven by on-site or off-site transportation requirements. 1. Inspection of waste containers upon receipt and prior to staging for shipment minimizes the likelihood of a spill during loading and unloading as a result of degraded waste containers. Postulated accident scenarios assuming waste container integrity include facility fires, spills, punctures, container explosions, facility explosions, and criticalities. 2. The FSAR safety analysis assumptions dealing with container strength and integrity stem from the containers meeting various requirements for safe transport of the containers. These requirements will be maintained to ensure that the containers located in the facility are consistent with the safety analysis assumptions.
Work Control	A Work Control program ensures that activities in the facility are conducted in a formal and controlled manner. Specific attributes of the Work Control program identified in the safety analysis include: 1. Work is performed using approved work instructions/ procedures. 2. A daily facility work planning and approval meeting is conducted.	Conducting work in a formal and controlled manner helps to minimize the consequences and occurrence of unauthorized work in the facility. 1. Providing an established process to verify that approved work instructions are used for performing work ensures that the performance of the activity associated with the work instruction does not introduce new hazards into the facility and has adequate controls in place to protect the worker. 2. An awareness of all activities to be conducted in the facility at any one time is necessary to avoid activity interactions that may introduce hazards in the facility. By having a facility work planning and approval meeting each day, the likelihood of undesirable activity interactions is reduced. Also, workers are made aware of other hazards in the facility that are not associated with their work which aids in worker protection.

Table 4-7 Building 991 Complex SMP Attributes

SMP	SMP ATTRIBUTE	BASIS
Work Control (continued)	3. Pre-Evolution Briefings are conducted.	3. By briefing all participants in an activity before performing the activity, personnel are made aware of the hazards, the controls, and the work instructions associated with the activity. This briefing helps to ensure that the work is performed as expected and that appropriate procedures and controls are used in the performance of the work.
	4. Work controls are implemented to ensure hazards remain separated from hazardous materials.	4. The FSAR safety analysis assumptions dealing with the likelihood of facility fires, spills, punctures, container explosions, facility explosions, and criticalities are based on operational restrictions in the Building 991 Complex. These operational restrictions ensure that either the likelihood of an accident is minimized or the consequences are reduced and ensure consistency with safety analysis assumptions.

4.8 SAFETY ANALYSIS ASSUMPTIONS AND FEATURES

Table 4-8 presents a summary listing of the general assumptions made (coded by the letter "G"), the assumptions made (coded by the letter "A"), the protective features credited (coded by the letter "F"), and the requirements imposed (coded by the letter "R") in the Safety Analysis in NSTR-011-98. These assumptions, features, and requirements were derived during the hazard evaluation and accident analysis of the Building 991 Complex and during the risk reduction evaluation of the dominant accident scenarios.

The scenarios to which each assumption, feature, or requirement applies are listed in Table 4-8 along with the impact of the assumption, feature, or requirement. Scenarios identified during the hazard evaluation process, presented in NSTR-011-98, are generally in the form of:

SCENARIO-NUMBER-ACTIVITY

and are displayed as left justified in Table 4-8. Scenarios identified during the bounding scenario selection process presented in NSTR-011-98, *Bounding Scenario Selection,* are generally in the form of:

B-SCENARIO-NUMBER

and are displayed as centered in Table 4-8. Scenarios identified during the accident analysis process presented in NSTR-011-98, *Accident Analysis,* or evaluated in the dominant accident scenario discussion of this chapter are generally in the form of:

Scenario NUMBER

and are displayed as right justified in Table 4-8. If the accident analysis scenario labels are shown in *italicized* print, then the assumption/feature/requirement was indirectly credited and will not be shown on the scenario summary tables. For example, if a scenario analysis that covers LLW and TRU waste containers is evaluated using only TRU waste containers, then General Assumption G2, dealing with LLW container MAR limits, may include the scenario in *italicized* print to indicate that the assumption was used in the selection of a bounding accident scenario even though the scenario summary table would not list the assumption. If the accident analysis scenario labels are shown in **bold** print, then the assumption/feature/requirement was credited in the dominant scenario discussion for risk reduction.

The impact of the assumption/feature/requirement is presented in the last column. This column provides the impact (i.e., established the criteria that was followed during the safety analysis) of the assumption/feature/requirement on the safety analysis and identifies any controls that were imposed based on the assumption/feature/requirement. Controls identified (shown as ***bold italicized*** in this column) were carried forward to the Appendix A, *Building 991 Complex Technical Safety Requirements.*

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
G1	LLW generated under the GEN activity has negligible contamination and will yield *low* consequences in all cases.	generally applied	Sets the potential consequences for many GEN activity scenarios. Not a control, only an assumption of the safety analysis
G2	LLW containers contain no more than 0.5 grams (WG Pu equivalent) in metal drums and 3 grams in wooden or metal boxes.	*Facility Fire Scenario 1* *Facility Fire Scenario 2* Facility Fire Scenario 3 Facility Fire Scenario 4 *Spill Scenario 1* *Spill Scenario 2* Puncture Scenario 1 *Facility Explosion Scenario 1* *NPH/EE Scenario 1* *NPH/EE Scenario 2* *NPH/EE Scenario 3*	Sets the potential MAR for many scenarios impacting LLW containers (3 grams for spills, punctures, and criticality potential). ***Container Radioactive Material Loading***
G3	Assumption deleted in Rev. 1.		
G4	TRU waste containers contain no more than 200 grams (WG Pu equivalent) in metal drums and 320 grams in metal boxes.	Facility Fire Scenario 1 Facility Fire Scenario 2 Spill Scenario 1 Spill Scenario 2 Puncture Scenario 1 Container Explosion Scenario 1 Facility Explosion Scenario 1 NPH/EE Scenario 1 NPH/EE Scenario 2 NPH/EE Scenario 3	Sets the potential MAR for many scenarios impacting waste containers (200 grams for facility fires and container explosions; 320 grams for facility fires, spills, punctures, container explosions, and criticality potential). ***Container Radioactive Material Loading***
G5	A pallet of TRU waste drums contains no more than 4 drums and only 2 drums can be impacted by forklift tines.	Spill Scenario 1 Puncture Scenario 1	Sets the potential MAR for many scenarios impacting pallets of waste containers (800 grams for pallet spills, material fires, and criticality potential; 400 grams for pallet punctures and material fires). Not a control, only an assumption of the safety analysis

Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
G6	POC containers contain no more than 1,255 grams (WG Pu equivalent) in metal drums and 200 grams (fissile material) in metal drums.	Puncture Scenario 1	Sets the potential MAR for many scenarios impacting POC containers (1,255 grams for facility fires and container explosions). *Container Radioactive Material Loading*
G7	A pallet of POC drums contains no more than 4 drums and only 1 drum can be impacted by forklift tines.	*Puncture Scenario 1*	Sets the potential MAR for many scenarios impacting pallets of POC containers (5,020 grams for pallet spills; 1,255 grams for punctures; 800 grams for criticality potential). Not a control, only an assumption of the safety analysis
G8	Type B containers cannot be impacted by activities other than the SNM and SURV activities due to their storage location and safeguards restrictions.	*Puncture Scenario 1*	Defines the potential interactions and corresponding types of containers for many scenarios. *SNM Only Staged in Vaults*
G9	Type B containers are assumed to contain no more than 6,000 grams (WG Pu equivalent) of oxide.	Puncture Scenario 1	Sets the potential MAR for many scenarios impacting Type B containers (6,000 grams for facility fires, spills, punctures, and criticality potential). Not a control, only an assumption of the safety analysis
G10	Type B containers containing pyrophoric material are assumed to contain no more than 2,000 grams (WG Pu equivalent) of metal.	generally applied	Sets the potential MAR for many scenarios impacting Type B pyrophoric material containers (2,000 grams for material fires). Not a control, only an assumption of the safety analysis
G11	Type B shipping containers, POC containers, and TRU waste containers will not be opened in the Building 991 Complex.	generally applied	Defines the potential interactions for many scenarios. *Containers Not Opened*
G12	TRU waste containers contain no more than 200 grams of fissionable material in drums.	B-CRIT-1 B-CRIT-2	Sets the potential MAR for criticality events involving TRU waste containers. *Container Fissionable Material Loading*

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
A1	The CHEM, CON, GEN, MAINT, and SURV activities require a very limited amount of container movements.	MFIRE-1-SURV, CHEM, CON, MAINT MFIRE-2-SURV, CHEM, CON, MAINT MFIRE-6-SURV, CHEM, CON, MAINT SPILL-1-GEN, SURV, CHEM, CON, MAINT SPILL-2-GEN, SURV, CHEM, CON, MAINT SPILL-5-GEN, SURV, CHEM, CON, MAINT SPILL-6-GEN, SURV, CHEM, CON, MAINT PUNCT-1-GEN, SURV, CHEM, CON, MAINT PUNCT-4-GEN, SURV, CHEM, CON, MAINT CRIT-1-GEN, SURV, CHEM, CON, MAINT CRIT-2-GEN, SURV, CHEM, CON, MAINT CRIT-3-GEN, SURV, CHEM, CON, MAINT B-SPILL-1 B-PUNCT-1 *Spill Scenario 1* *Puncture Scenario 1*	Reduces the likelihood of some direct interaction scenarios dealing with container movements, other than container explosion scenarios, by one frequency bin. Not a control, only an assumption of the safety analysis
A2	Damaging high winds and heavy snows are *anticipated* events except over vaults; damaging lightning strikes are *anticipated* events; freezing events impacting the complex are *anticipated*; damaging heavy rains and flooding are *unlikely* events; facility collapse due to seismic events is *unlikely* except for below ground vaults; damaging tornadoes are *unlikely* events; damaging range fires are *extremely unlikely* events.	MFIRE-3-SNM, WASTE MFIRE-8-SNM, WASTE SPILL-3-GEN, SNM, WASTE SPILL-7-GEN, WASTE PUNCT-3-GEN, SNM, WASTE PUNCT-6-GEN, WASTE CRIT-4-GEN, SNM, WASTE *NPH/EE Scenario 1* *NPH/EE Scenario 2* *NPH/EE Scenario 3*	Sets the likelihood of natural phenomena events. Not a control, only an assumption of the safety analysis

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
A3	Damaging tunnel failure and floor loading failures are *unlikely* events; damaging aircraft crashes are *extremely unlikely* events	MFIRE-3-SNM, WASTE MFIRE-8-SNM, WASTE SPILL-3-GEN, SNM, WASTE SPILL-7-GEN, WASTE PUNCT-3-GEN, SNM, WASTE PUNCT-6-GEN, WASTE CRIT-4-GEN, SNM, WASTE SPILL-3-SNM, WASTE [aircraft crash] PUNCT-3-SNM, WASTE [aircraft crash] CRIT-4-SNM, WASTE [aircraft crash] B-SPILL-1 B-SPILL-2 B-PUNCT-1 B-PUNCT-2 B-CRIT-1 *Spill Scenario 1* *Spill Scenario 2* *Puncture Scenario 1*	Sets the likelihood of some internal and external events. Not a control, only an assumption of the safety analysis
A4	Natural gas system failure leading to an explosion impacting the facility is an *extremely unlikely* event.	FEXPLO-1-GEN, WASTE FEXPLO-2-GEN, WASTE CRIT-5-GEN, WASTE B-FEXPLO-1 B-CRIT-2	Sets the likelihood for facility explosion events. Not a control, only an assumption of the safety analysis
A5	Vault areas are not expected to be impacted by facility explosions involving natural gas.	MFIRE-4-SNM FEXPLO-1-SNM CRIT-5-SNM	Reduces the likelihood of container failure, for containers located in vaults, *from scenarios dealing with natural gas explosions to Beyond Extremely Unlikely.* Not a control, only an assumption of the safety analysis

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
A6	The CHEM, CON, GEN, MAINT, RA, and SURV activities perform limited operations with material handling equipment.	MFIRE-7-GEN, SURV, CHEM, CON, MAINT, RA SPILL-4-GEN, SURV, CHEM, CON, MAINT, RA SPILL-8-GEN, SURV, CHEM, CON, MAINT, RA PUNCT-2-GEN, SURV, CHEM, CON, MAINT, RA PUNCT-5-GEN, SURV, CHEM, CON, MAINT, RA CEXPLO-1-GEN, CHEM, CON, MAINT, RA CRIT-6-GEN, SURV, CHEM, CON, MAINT, RA B-SPILL-1 B-PUNCT-1 *Spill Scenario 1* *Puncture Scenario 1*	Reduces the likelihood of some indirect interaction scenarios dealing with material handling equipment impacts on other activity containers by one frequency bin. Not a control, only an assumption of the safety analysis
A7	Due to the limited amount of waste generation under GEN and the expected locations for the activity, direct exposure of the waste container to propane or other flammable gases is considered to be a *beyond extremely unlikely* event.	PFIRE-1-GEN	Reduces the likelihood of GEN activity waste container failure from scenarios dealing with direct exposure to flammable gases (i.e., torches) to *Beyond Extremely Unlikely*. Not a control, only an assumption of the safety analysis
A8	The SNM activity performs operations with material handling equipment in proximity to metal waste containers but is *unlikely* to interact with hydrogen generating waste drums.	CEXPLO-1-SNM	Reduces the likelihood of indirect interaction scenarios dealing with material handling equipment impacts on other activity hydrogen generating containers by one frequency bin. Not a control, only an assumption of the safety analysis
A9	At least 10 kilograms of plutonium oxide is required to yield a criticality involving waste material.	CRIT-1-GEN CRIT-2-GEN, WASTE, SURV, CHEM, CON, MAINT CRIT-3-GEN, WASTE, SURV, CHEM, CON, MAINT CRIT-4-GEN, WASTE CRIT-5-GEN, WASTE, CON, MAINT CRIT-6-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA B-CRIT-1 B-CRIT-2	Reduces the likelihood of criticalities from scenarios dealing with less than 10 kilograms of plutonium contaminated waste to *Beyond Extremely Unlikely*. Not a control, only an assumption of the safety analysis

Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
A10	Pyrophoric materials (e.g., uranium fines) are not introduced into the facility under the WASTE activity.	MFIRE-1-WASTE, SURV, CHEM, CON, MAINT MFIRE-2-WASTE, SURV, CHEM, CON, MAINT MFIRE-3-WASTE MFIRE-4-WASTE, CON, MAINT MFIRE-5-GEN, WASTE, SURV, CHEM, CON, MAINT, RA MFIRE-6-WASTE, SURV, CHEM, CON, MAINT MFIRE-7-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA MFIRE-8-WASTE	Reduces the likelihood of pyrophoric material waste container failure from direct interaction scenarios or indirect equipment impact scenarios to *Beyond Extremely Unlikely.* *No TRU Pyrophoric*
A11	Assumption deleted Rev. 1.		
A12	Transport vehicle fires are *unlikely* events.	FFIRE-2-GEN, SNM, WASTE B-FFIRE-2	Sets the likelihood of the event. Not a control, only an assumption of the safety analysis
A13	Due to the limited amount of waste generation under GEN and the expected locations for the activity, exposure of the waste container to transport vehicle fires is considered to be an *unlikely* event.	FFIRE-2-GEN	Reduces the likelihood of GEN activity waste container exposure to scenarios dealing with transport vehicle fires by one frequency bin. Not a control, only an assumption of the safety analysis
A14	Due to the lower likelihood that transport vehicle fires deal with the diesel fuel on the vehicle and the protection afforded by the cargo bed of the trailer, transport vehicle fire propagation to waste containers is an *unlikely* event.	FFIRE-2-GEN, WASTE B-FFIRE-2	Reduces the likelihood of waste container failure from scenarios dealing with transport vehicle fires by one frequency bin. Not a control, only an assumption of the safety analysis
A15	Natural gas or propane explosions are not expected to occur following an aircraft crash event due to the fire associated with the event preventing the buildup of gases to explosive levels.	FEXPLO-1 [aircraft crash] FEXPLO-2 [aircraft crash] CRIT-5 [aircraft crash]	Reduces the likelihood of radioactive material container failure from scenarios dealing with natural gas or propane explosions following an aircraft crash to *Beyond Extremely Unlikely.* Not a control, only an assumption of the safety analysis

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
A16	Natural gas or propane explosions are not expected to occur following high wind or tornado events due to the wind dispersal of the flammable gases preventing the buildup of gases to explosive levels.	FEXPLO-1 [high wind] FEXPLO-1 [tornado] FEXPLO-2 [high wind] FEXPLO-2 [tornado] CRIT-5 [high wind] CRIT-5 [tornado]	Reduces the likelihood of radioactive material container failure from scenarios dealing with natural gas or propane explosions following high wind or tornado events to *Beyond Extremely Unlikely.* Not a control, only an assumption of the safety analysis
A17	Forces associated with waste storage area flooding following heavy rain, flooding, or freezing induced flooding events are not expected to be sufficient to result in waste container stack toppling.	SPILL-4 [heavy rain] SPILL-4 [flooding] SPILL-4 [freezing] SPILL-8 [heavy rain] SPILL-8 [flooding] SPILL-8 [freezing]	Reduces the likelihood of radioactive material container failure from scenarios dealing with flooding following heavy rain, flooding, or freezing induced flooding events to *Beyond Extremely Unlikely.* Not a control, only an assumption of the safety analysis
A18	Propane or other flammable gas torches are *unlikely* to breach both the outer drum and the inner pipe component of a POC container without intentional flame direction.	B-FFIRP-3	Reduces the likelihood of POC container failure from scenarios dealing with flammable gas torch direct flame impingement breach of the container by one frequency bin. Not a control, only an assumption of the safety analysis
A19	A drop/fall of banded TRU or low-level waste containers results in the equivalent release of material of one waste container.	Spill Scenario 1 NPH/EE Scenario 2	Sets the potential MAR for the scenario impacting TRU or low-level waste containers. *Banding*
A20	The floor loading capacity of the hallways is adequate to handle the expected loads.	*Spill Scenario 2*	Reduces the frequency of the scenario dealing with overloading the hallway floor to *Extremely Unlikely.* Not a control, only an assumption of the safety analysis
A21	The number of drums breached due to structural failure of the hallway floor is the same in the spill and puncture scenarios.	B-PUNCT-2 *Spill Scenario 2*	Defines the number of drums for the scenario so that one analysis can be used to address both scenarios. Not a control, only an assumption of the safety analysis

Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
A22	No more than 10% of contaminated waste fissionable material in breached waste containers will migrate out of containers and into solution in scenarios involving flooding or sprinkler actuation.	B-CRIT-1 B-CRIT-2	Reduces the amount of material that can be collected in criticality scenarios involving breached containers and water. Not a control, only an assumption of the safety analysis
F1	Type B shipping containers cannot be breached by falls from any heights expected during operation.	MFIRE-1-SNM, SURV SPILL-1-SNM, SURV CRIT-2-SNM, SURV *Spill Scenario 1* *NPH/EE Scenario 2*	Reduces the likelihood of Type B shipping container failure from scenarios dealing with dropped containers to *Beyond Extremely Unlikely*. ***Type B Shipping Container***
F2	POC containers cannot be breached by falls from any heights expected during operation.	SPILL-1-WASTE, SURV, CHEM, CON, MAINT SPILL-4-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA *Spill Scenario 1* *NPH/EE Scenario 2*	Reduces the likelihood of POC container failure from scenarios dealing with dropped containers to *Beyond Extremely Unlikely*. *POC Container*
F3	Metal waste containers are *unlikely* to be breached by non-forklift tine impacts from material handling equipment expected during operation.	MFIRE-2-WASTE, SURV, CHEM, CON, MAINT SPILL-2-GEN, WASTE, SURV, CHEM, CON, MAINT B-SPILL-1 Spill Scenario 1 Spill Scenario 2	Reduces the likelihood of metal waste container failure for scenarios dealing with material handling equipment impacts with containers, other than forklift tine puncture scenarios, by one frequency bin. ***Metal Waste Container***
F4	Type B shipping containers cannot be breached by material handling equipment impacts expected during operation.	MFIRE-2-SNM, SURV SPILL-2-SNM, SURV CRIT-3-SNM, SURV	Reduces the likelihood of Type B shipping container failure from scenarios dealing with material handling equipment impacts with containers to *Beyond Extremely Unlikely*. ***Type B Shipping Container***

Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
F5	POC containers cannot be breached by material handling equipment impacts expected during operation.	SPILL-2-WASTE, SURV, CHEM, CON, MAINT	Reduces the likelihood of POC container failure from scenarios dealing with material handling equipment impacts with containers to *Beyond Extremely Unlikely*. *POC Container*
F6	Type B shipping containers are *unlikely* to be breached by structural member impacts due to impact angle requirements and weight needed to lead to failure.	MFIRE-3-SNM MFIRE-8-SNM SPILL-3-SNM PUNCT-3-SNM CRIT-4-SNM SPILL-3-SNM [aircraft crash] PUNCT-3-SNM [aircraft crash] CRIT-4-SNM [aircraft crash] B-CRIT-1 *NPH/EE Scenario 1* *NPH/EE Scenario 2*	Reduces the likelihood of Type B shipping container failure for scenarios dealing with structural members impacting containers by one frequency bin. *Type B Shipping Container*
F7	POC containers are *unlikely* to be breached by structural member impacts due to impact angle requirements and weight needed to lead to failure.	SPILL-3-WASTE PUNCT-3-WASTE CRIT-4-WASTE SPILL-3-WASTE [aircraft crash] PUNCT-3-WASTE [aircraft crash] CRIT-4-WASTE [aircraft crash] B-SPILL-2 B-PUNCT-2 B-CRIT-1 *Spill Scenario 2* *NPH/EE Scenario 1* *NPH/EE Scenario 2* *NPH/EE Scenario 3*	Reduces the likelihood of POC container failure for scenarios dealing with structural members impacting containers by one frequency bin. *POC Container*

Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
F8	Type B shipping containers cannot be breached by any external flammable gas explosions expected during operation.	MFIRE-4-SNM FEXPLO-1-SNM CRIT-5-SNM *Facility Explosion Scenario 1*	Reduces the likelihood of Type B shipping container failure from scenarios dealing with natural gas or propane explosions to *Beyond Extremely Unlikely*. ***Type B Shipping Container***
F9	POC containers cannot be breached by any external flammable gas explosions expected during operation.	FEXPLO-1-WASTE, CON, MAINT CRIT-5-WASTE, CON, MAINT B-FEXPLO-1 B-CRIT-2 *Facility Explosion Scenario 1*	Reduces the likelihood of POC container failure from scenarios dealing with natural gas or propane explosions to *Beyond Extremely Unlikely*. ***POC Container***
F10	Metal waste containers are ***unlikely*** to be breached by forklift tine impacts due to impact angle requirements needed to lead to failure and waste packaging.	MFIRE-6-WASTE, SURV, CHEM, CON, MAINT MFIRE-7-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA PUNCT-1-GEN, WASTE, SURV, CHEM, CON, MAINT PUNCT-2-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA B-PUNCT-1 Puncture Scenario 1	Reduces the likelihood of metal waste container failure for scenarios dealing with forklift tines impacting containers by one frequency bin. ***Metal Waste Container***
F11	Type B shipping containers are ***extremely unlikely*** to be breached by forklift tine impacts due to impact angle requirements needed to lead to failure and SNM packaging.	MFIRE-6-SNM, SURV PUNCT-1-SNM, SURV B-PUNCT-1 Puncture Scenario 1	Reduces the likelihood of Type B shipping container failure for scenarios dealing with forklift tines impacting containers by two frequency bins. ***Type B Shipping Container***

Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
F12	POC containers are *extremely unlikely* to be breached by forklift tine impacts due to impact angle requirements needed to lead to failure and waste packaging.	PUNCT-1-WASTE, SURV, CHEM, CON, MAINT PUNCT-2-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA B-PUNCT-1 Puncture Scenario 1	Reduces the likelihood of POC container failure for scenarios dealing with forklift tines impacting containers by two frequency bins. *POC Container*
F13	Metal waste containers are *extremely unlikely* to be breached by internal hydrogen explosions due to metal waste container venting.	CEXPLO-1-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA B-CEXPLO-1 Container Explosion Scenario 1	Reduces the likelihood of metal waste container failure for scenarios dealing with internal hydrogen explosions by two frequency bins. *Waste Container Vents*
F14	POC containers cannot be breached by any potential internal hydrogen explosions.	CEXPLO-1-WASTE, SURV *Container Explosion Scenario 1*	Reduces the likelihood of POC container failure from scenarios dealing with internal hydrogen explosions to *Beyond Extremely Unlikely*. *POC Container*
F15	Type B shipping containers cannot be breached by any external fires expected during operation, except direct flame impingement torch fires.	FFIRE-2-SNM FFIRE-3-SNM B-FFIRE-1 *Facility Fire Scenario 1* *Facility Fire Scenario 2*	Reduces the likelihood of Type B shipping container failure from scenarios dealing with facility fires, other than direct flame impingement torch fires, to *Beyond Extremely Unlikely*. *Type B Shipping Container*
F16	POC containers cannot be breached by any external fires expected during operation, except direct flame impingement torch fires.	FFIRE-2-WASTE FFIRE-3-WASTE, CHEM, CON, MAINT, RA B-FFIRE-1 *Facility Fire Scenario 1* *Facility Fire Scenario 2*	Reduces the likelihood of POC container failure from scenarios dealing with facility fires, other than direct flame impingement torch fires, to *Beyond Extremely Unlikely*. *POC Container*

Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
F17	Flammable gas containers are *unlikely* to be breached during use.	FFIRE-3-CON, MAINT FFIRE-4-CON, MAINT FEXPLO-1-CON, MAINT FEXPLO-2-CON, MAINT CRIT-5-CON, MAINT B-FFIRE-3 B-FEXPLO-1 B-CRIT-2 Facility Fire Scenario 1 Facility Fire Scenario 2 Facility Fire Scenario 3 Facility Fire Scenario 4 Facility Explosion Scenario 1	Reduces the likelihood of explosion or fire scenarios due to use of flammable gases by one frequency bin. ***Flammable Gas Container***
F18	Feature deleted Rev. 1.		
F19	Feature deleted Rev. 1.		
F20	Office area fires are prevented from propagating to waste storage areas by a combination of fire barriers and fire doors.	B-FFIRE-1	Reduces the likelihood of fire propagation from the Office Area to waste storage areas by one frequency bin ***Office Area to Waste Area Fire Doors***
F21	Fire extinguishers are available and well maintained to allow personnel fire suppression actions.	Facility Fire Scenario 1 Facility Fire Scenario 2 Facility Fire Scenario 3 Facility Fire Scenario 4	Reduces the likelihood of fire growth from the small fires to medium fires by one frequency bin ***Fire Extinguishers***
F22	Automatic sprinkler systems are located in all waste storage areas, except Building 996, and in the Office Areas and are well maintained.	B-FFIRE-1 Facility Fire Scenario 1 Facility Fire Scenario 2 Facility Fire Scenario 3 Facility Fire Scenario 4	Reduces the likelihood of fire growth from the medium fires to larger fires by one frequency bin ***Automatic Sprinkler Systems***

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
F23	Metal waste container lids cannot be removed from the containers due to internal overpressurize from exposure to expected fires.	Facility Fire Scenario 1 Facility Fire Scenario 2	Reduces the likelihood of metal waste container fire-induced lid loss associated with expected fires to *Beyond Extremely Unlikely*. ***Metal Waste Container***
F24	Metal waste container fires cannot propagate from container to container by exposure to expected fires.	Facility Fire Scenario 1 Facility Fire Scenario 2	Reduces the likelihood of metal waste container fire container-to-container propagation associated with expected fires to *Beyond Extremely Unlikely*. ***Metal Waste Container***
F25	Wooden waste containers prevent direct exposure of fires to container contents for expected fires.	Facility Fire Scenario 3 Facility Fire Scenario 4	In combination with ***wooden waste crate liners***, reduces the consequences from LLW crate fires by two orders of magnitude. ***Wooden Waste Container***
F26	Actuation of the automatic sprinkler systems will yield a flow alarm at the Fire Dispatch Center and will result in Fire Department response.	Facility Fire Scenario 2 Facility Fire Scenario 4	Reduces the consequences of fires larger than those analyzed in the safety analysis. ***Flow Alarms/Fire Department Response***
F27	Actuation of the smoke detection system will yield an alarm at the Fire Dispatch Center and will result in Fire Department response.	Facility Fire Scenario 2	Reduces the consequences of fires larger than those analyzed in the safety analysis in Building 996 waste container storage areas. ***Smoke Detectors/Fire Department Response***
F28	TRU and low-level waste containers cannot be breached by falls less than four feet.	B-CRIT-1 Spill Scenario 1 NPH/EE Scenario 1 NPH/EE Scenario 2 NPH/EE Scenario 3	Reduces the likelihood of TRU and low-level waste container failure due to dropping from less than four feet to *Beyond Extremely Unlikely*. ***Metal Waste Container***

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
F29	Metal waste drums cannot be breached by an external explosion peak overpressure less than 22 psig.	B-CRIT-2 *Facility Explosion Scenario 1*	Limits the MAR associated with facility explosions to containers breached by falling debris versus direct explosion impacts. ***Metal Waste Drum***
F30	Building 991 filtered exhaust ventilation is directly applied to the north waste container storage areas and indirectly applied to the south waste container storage areas other than Room 166.	Dominant Facility Fire Scenario 1 Dominant Facility Fire Scenario 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	Reduces the radiological consequences to the collocated worker and the public from operationally induced facility fires, spills, punctures, and container explosions. ***Building 991 Filtered Exhaust Ventilation System***
F31	Building 985 filtered exhaust ventilation is directly applied to some north waste container storage areas when the ventilation system is being used.	Dominant Facility Fire Scenario 1 Dominant Facility Fire Scenario 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	Reduces the radiological consequences to the collocated worker and the public from operationally induced facility fires, spills, punctures, and container explosions. ***Building 985 Filtered Exhaust***
R1	Stacking of Type B shipping containers is prohibited	MFIRE-5-SNM SPILL-4-SNM CRIT-6-SNM B-SPILL-1 *Spill Scenario 1* *NPH/EE Scenario 2*	Reduces the likelihood of Type B shipping container spills associated with stack toppling to *Beyond Extremely Unlikely*. ***Type B Shipping Container Stacking Restriction***
R2	Propane or other flammable gases are prohibited from vaults while SNM is present.	FFIRE-1-SNM B-FFIRE-3	Reduces the likelihood of Type B shipping container breaches associated with direct flame impingement from torches to *Beyond Extremely Unlikely*. ***Flammable Gas Prohibited in Vaults with SNM***

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
R3	Work controls are required to ensure that waste container direct exposure to propane or other flammable gas flames is an *extremely unlikely* event.	FFIRE-1-WASTE, CON, MAINT B-FFIRE-1	Reduces the likelihood of metal waste container failure from scenarios dealing with direct exposure to flammable gases (*i.e.*, torches) to *Extremely Unlikely*. *Flammable Gas Not Near Containers*
R4	Type B shipping containers shall be designed and used in a manner to preclude a criticality as long as the containers remain intact.	CRIT-1-SNM, SURV CRIT-2-SNM, SURV CRIT-3-SNM, SURV CRIT-7-SNM CRIT-8-SNM	Reduces the likelihood of intact Type B shipping container criticalities to *Beyond Extremely Unlikely*. *Criticality Controls*
R5	Waste containers in the Building 991 Complex shall be designed and used in a manner to preclude a criticality as long as the containers remain intact.	CRIT-1-WASTE, SURV, CHEM, CON, MAINT CRIT-7-WASTE CRIT-8-WASTE	Reduces the likelihood of intact waste container criticalities to *Beyond Extremely Unlikely*. *Criticality Controls*
R6	Requirement deleted Rev. 1.		
R7	Requirement deleted Rev. 1.		
R8	A combustible material and ignition source control program shall be implemented to make fires in areas containing staged, stored, or in-process (*i.e.*, GEN activity) radioactive material *unlikely* events.	FFIRE-3-GEN, SNM, WASTE, CHEM, CON, MAINT, RA FFIRE-4-GEN, WASTE, CHEM, CON, MAINT, RA B-FFIRE-3 Facility Fire Scenario 1 Facility Fire Scenario 2 Facility Fire Scenario 3 Facility Fire Scenario 4 NPH/EE Scenario 1 NPH/EE Scenario 2	Reduces the likelihood of facility fires potentially impacting radioactive material to *Unlikely*. *Combustible Material Control* *Ignition Source Control*
R8a	Elements of combustible material control include: • high heat release rate combustible material restrictions; • no wooden crates in internal waste storage areas; • combustibles have five foot separation from waste containers.		
R8b	Elements of ignition source control include: • restrictions on smoking in facilities; • hot work permits.		

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
R9	A hot work control program shall be implemented to make flammable gas explosions in areas containing staged, stored, or in-process (*i.e.*, GEN activity) radioactive material *unlikely* events.	FEXPLO-1-CON, MAINT FEXPLO-2-CON, MAINT CRIT-5-CON, MAINT B-FEXPLO-1 B-CRIT-2 *Facility Explosion Scenario 1*	Reduces the likelihood of facility explosions potentially impacting radioactive material by one frequency bin. ***Hot Work Control***
R10	Type B shipping containers received at Building 991 shall meet the requirements of 1-W89-HSP-31.11.	MFIRE-3-SNM MFIRE-6-SNM, SURV MFIRE-8-SNM	Reduces the likelihood of a Type B shipping container containing pyrophoric material to *unlikely.* ***Container Radioactive Material Loading***
R11	Requirement deleted Rev. 1.		
R12	The Building 991 Complex will develop an Emergency Plan for the facilities in the complex.	Facility Fire Scenario 1 Facility Fire Scenario 2 Facility Fire Scenario 3 Facility Fire Scenario 4 Spill Scenario 1 Spill Scenario 2 Puncture Scenario 1 Container Explosion Scenario 1 NPH/EE Scenario 3	Reduces the exposure of the IW to releases. ***Emergency Plan***
R13	Requirement deleted Rev. 1.		
R14	Requirement deleted Rev. 1.		
R15	Electrical systems in the Building 991 Complex are maintained sufficiently to prevent fires from hot shorts becoming *anticipated* events.	Facility Fire Scenario 1 Facility Fire Scenario 2 Facility Fire Scenario 3 Facility Fire Scenario 4	Reduces the likelihood of fires from electrical system failures to *unlikely* or *extremely unlikely* events. ***Electrical System Maintenance***

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
R16	All wooden LLW crates stored in the Building 991 Complex shall have liners.	Facility Fire Scenario 3 Facility Fire Scenario 4	In combination with *wooden waste container*, reduces the consequences from LLW crate fires by two orders of magnitude. ***Wooden Waste Crate Liners***
R17	No more than 50 wooden LLW crates may be stored in the West Dock Canopy waste storage area.	Facility Fire Scenario 4	Limits the consequences from major LLW crate fires. ***50 Wooden LLW Crate Limit***
R18	Requirement deleted Rev. 1.		
R19	Storage of waste containers in Corridor C is prohibited.	B-CRIT-1 *Spill Scenario 2*	Eliminated analysis of structural failure of the corridor and its potential impact on the MOI, CW, and IW. *Storage of Waste Containers in Corridor C Prohibited*
R20	Waste containers stacked above the second tier will be banded.	Spill Scenario 1 NPH/EE Scenario 2	Reduces the effective MAR of the scenario due to a pallet of TRU waste container dropping or falling from the third or fourth tier of the stack. ***Banding***
R21	The Building 991 Complex will comply with Radiation Protection program guidance.	Spill Scenario 1 Spill Scenario 2 Puncture Scenario 1	Reduces the exposure to the IW to releases. ***Radiation Protection***
R22	Waste containers to be stored in the Building 991 Complex shall not contain liquids.	Container Explosion Scenario 1	Reduces the likelihood of internal hydrogen explosions in containers by reducing the potential rate of hydrogen generation. ***Liquids in Waste Prohibited***

Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
R23	The use of flammable gas in Room 135, Room 142, Room 143, Room 148, Room 158, and Building 996 is prohibited.	B-FEXPLO-1 B-CRIT-2 Facility Explosion Scenario 1	Limits the MAR associated with facility explosions to containers breached by falling debris versus direct explosion impacts. ***Use of Flammable Gas in Room 135, Room 142, Room 143, Room 148, Room 158, and Building 996 is Prohibited***
R24	The flammable gas inventory in Room 134, Room 140/141/153, Room 151, Room 155, Room 166, Room 170, and Building 998 shall be limited to 150 ft^3.	B-CRIT-2 Facility Explosion Scenario 1	Limits the MAR associated with facility explosions to containers breached by falling debris versus direct explosion impacts. ***Flammable Gas Inventory***
R25	The glass pane window in Room 166 shall be covered or eliminated.	B-FEXPLO-1 B-CRIT-2	Reduces the likelihood of gas getting into Room 166 with a subsequent gas explosion that can impact waste containers stored in the room to a *beyond extremely unlikely* event. Superceded by Room 166 waste storage restrictions [R26]
R26	Room 166 can only be used to store POC containers; metal waste containers other than POC containers are prohibited from storage in Room 166.	B-FEXPLO-1 B-CRIT-2 Dominant Facility Fire Scenario 1 Dominant Facility Fire Scenario 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	In combination with *POC container*, reduces the likelihood of a natural gas explosion in Room 166 impacting radioactive material to a *Beyond Extremely Unlikely* event. ***Restrict Room 166 Storage to POC Containers***
R27	Facility doors are configured in a manner to allow the north waste container storage area ventilation to ventilate the south waste container storage areas, other than Room 166.	Dominant Facility Fire Scenario 1 Dominant Facility Fire Scenario 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	Reduces the radiological consequences to the collocated worker and the public from operationally induced facility fires, spills, punctures, and container explosions in the south waste container storage areas. ***Building 991 Facility Configuration***

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Table 4-8 Assumptions and Features for Analyzed Scenarios

#	ASSUMPTION/ CREDITED FEATURE/REQUIREMENT	SCENARIO CODE	ASSUMPTION/FEATURE/ REQUIREMENT IMPACT
R28	Room 170 differential pressure with respect to atmosphere is verifiable.	Dominant Facility Fire Scenario 1 Dominant Facility Fire Scenario 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	Reduces the radiological consequences to the collocated worker and the public from operationally induced facility fires, spills, punctures, and container explosions in the south waste container storage areas. ***Room 170 Differential Pressure***
R29	Operations in Rooms 147 and 170 are restricted while Room 170 dock doors are open.	Dominant Facility Fire Scenario 1 Dominant Facility Fire Scenario 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	Reduces the radiological consequences to the collocated worker and the public from operationally induced facility fires, spills, punctures, and container explosions in the south waste container storage areas. ***Rooms 147 and 170 Operations Restrictions***
R30	Containers may not be stacked above a second tier during Room 170 receipt and shipment operations.	Dominant Spill Scenario 1	Reduces the likelihood of operationally induced spills in Room 170 while dock doors are open. ***No Stacking Above Second Tier While Dock Doors Open***

4.9 REFERENCES

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CHAPTER 6

DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

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6. DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

6.1 INTRODUCTION

The Technical Safety Requirements (TSRs) for Building 991, provided as Appendix A, *Building 991 Complex Technical Safety Requirements*, to the Final Safety Analysis Report (FSAR), establish those requirements that define the conditions, safe boundaries, and Administrative Controls (ACs) necessary to ensure safe operation of the building and reduce the risk to the maximum [exposed] off-site individual (MOI), collocated workers (CW), immediate workers (IW), and the environment from an uncontrolled release of hazardous materials. There are four types of controls used to provide this assurance: Limiting Conditions for Operations (LCOs), Surveillance Requirements (SRs), ACs, and Design Features. The TSRs constitute an agreement between the Department of Energy (DOE)/Rocky Flats Field Office (RFFO) and the facility operating management regarding safe operation of the facility.

This chapter derives the Building 991 Complex TSRs and identifies the operational controls defining the safe conditions and the ACs based on the safety analyses presented in Nuclear Technical Safety Report (NSTR)-011-98, *Safety Analysis for the Building 991 Complex Final Safety Analysis Report* (Ref. 1). This chapter supports and provides information necessary for the separate TSR document attached to this FSAR as Appendix A. Compliance with the TSRs ensures that the health and safety of the MOI and CW are protected from an uncontrolled release of radioactive and hazardous materials and ensures that potential risks to the IW are reduced based on the controls implemented.

This chapter establishes the bases for the selection of the control set required to establish the safe boundaries and ACs for the Building 991 Complex. The TSRs were selected and prepared in accordance with DOE 5480.22, *Technical Safety Requirements* (Ref. 2) and the *Document of Example Technical Safety Requirements, Volume I* (Ref. 3).

6.2 TYPES AND DERIVATION OF REQUIREMENTS

6.2.1 Limiting Conditions for Operations

LCOs are imposed on structures, systems, and components (SSCs) credited in the FSAR to reduce the frequency of postulated accidents or mitigate the consequences of postulated accidents to the MOI and/or CW. LCOs provide the lowest functional capability or performance levels of safety-related SSCs, and their support systems, required for normal, safe operation of the facility. Table 6-1 correlates specifically credited safety features identified in the hazard and accident analysis to the appropriate TSR LCO. The Building 991 Complex LCOs address the following systems:

- Automatic Sprinkler Systems and Flow/Smoke Detection Alarms.
- Filtered Exhaust Ventilation Systems

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• Automatic Plenum Deluge Systems

6.2.2 Surveillance Requirements

SRs are requirements relating to testing, calibration, or inspection to ensure the necessary Operability of safety-related SSCs and their support systems. This section of the TSRs contains the requirements necessary to maintain operation of the Building 991 Complex within the LCOs. In the event that SRs are not successfully completed or accomplished within their specified frequency, the systems or components involved are assumed to be not Operable and Required Actions defined by the LCOs are taken until the system or components can be shown to be Operable.

SRs for each system or component identified in a specific LCO are provided subsequent to the LCO itself. These SRs add assurance that those systems and components that the safety analysis credits for prevention of postulated accidents or mitigation of postulated accident consequences will perform their intended functions.

6.2.3 Administrative Controls

ACs are provisions relating to organization and management, conduct of operations, procedures, record-keeping, assessment, and reporting necessary to ensure safe operation of the building. The ACs for the Building 991 Complex consist of credited programmatic elements and specific controls or restrictions. Table 6-2 correlates specific administrative controls credited in the hazard and accident analysis to the appropriate TSR AC or Safety Management Program (SMP).

Some of the ACs provide discrete administrative controls/limits that have been credited in the safety analysis. These specific controls or restrictions are credited as providing a reduction in postulated accident scenario initiation frequency and/or a reduction in postulated accident scenario consequences. Such controls are more precise and discrete than those defined by a SMP or the program elements of a SMP. The ACs with specific controls or restrictions have requirements for verification of the control or restriction and requirements for actions following discovery of a noncompliance with the control or restriction. Examples of ACs with specific controls or restrictions include: Inventory Control and Material Management (AC 5.2) and Control of Combustible Materials and Ignition Sources (AC 5.3).

6.2.4 Design Features

Design Features are passive features that reduce the frequency and/or mitigate the consequences of uncontrolled releases of radioactive or other hazardous materials from the building for postulated accident scenarios analyzed in the FSAR. Design Feature descriptions are provided in the TSRs to assure that evaluations of proposed changes or modifications to the Design Features are properly performed and documented, consistent with requirements specified in the TSRs. An example of a Design Feature credited in the FSAR is the internal fire barrier that prevents office area fires from impacting waste containers in the waste storage areas.

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Maintenance of this Design Feature is addressed in the TSRs in Section 6, Design Features. Table 6-1 correlates the Design Features specifically credited in the hazard and accident analysis to the TSR Design Feature.

6.3 TECHNICAL SAFETY REQUIREMENTS COVERAGE

This section provides assurances that the TSR coverage for the Building 991 Complex is complete. This section lists the features identified in NSTR-011-98, *Safety Analysis for the Building 991 Complex Final Safety Analysis Report* and Chapter 5, *Structures, Systems, and Components*, that are needed to provide public safety, significant defense-in-depth, or significant worker safety. The working definitions used throughout this FSAR in determining the control feature are as follows:

Public Safety: Those features that have been determined to be essential to assuring public safety or worker nuclear safety related to immediate fatalities or serious injuries or that maintain the consequences of facility operations below an established evaluation guideline. These features are identified as System Category (SC)-1/2 SSCs if the MOI and/or CW could sustain *moderate* or *high* consequences, depending on scenario frequency.

Defense-in-Depth: Those features that provide an additional layer of defense against release of hazardous materials to the environment. Defense-in-depth features include both facility SSCs and administrative features. SSCs that are major contributors to defense-in-depth are designated as SC-3 SSCs.

Worker Safety: Those features that provide protection to the IW from the hazards of facility operation, exclusive of standard industrial hazards. Worker safety features include both facility SSCs and administrative features. SSCs that are major contributors to worker safety are designated as SC-3 SSCs.

Table 6-1 lists all of the controls concerning Building 991 SSCs identified during the hazard evaluation and accident analysis presented in NSTR-011-98. This table describes the credited control and describes the safety feature being relied upon for that control. The control feature of the credited control is then defined. The control feature may be either public safety (PS), defense-in-depth (DID), or worker safety (WS), as defined above, or any combination of these features. The control type is then provided. The control type identifies the system category of the credited control (i.e., SC-1/2 or SC-3). The TSR control column provides the linkage to Appendix A, *Building 991 Complex Technical Safety Requirements*, to indicate control coverage in the TSRs. And finally, the accident scenario column provides the linkage to the accident scenario or accident scenario types where the control is credited.

Table 6-1 Matrix of Building 991 Controls, Safety Features, and TSR Control

Control	Safety Feature	Control Feature[1]			Control Type	TSR Control	Accident Scenario
		PS	DID	WS			
Automatic Sprinkler Systems (Automatic sprinkler systems are located in all waste storage areas, except Building 996, and in the Office Areas and are well maintained). *Automatic Sprinkler Systems*	The safety function of the automatic sprinkler system is to suppress postulated fires occurring in the Building 991 Complex office areas and reduce the likelihood that office area fires will impact waste container storage areas. The system is also credited with mitigating the effects of any fires that may occur in the waste container storage areas. The automatic sprinkler system also provides a defense-in-depth safety function for postulated accident scenarios. The safety function of the automatic sprinkler system in these scenarios is to mitigate the effects of the fire and to prevent the fire from propagating into a large fire.	✓	✓	✓	SC-1/2	LCO 3.1	B-FFIRE-1 Facility Fire Scenarios 1, 2, 3, and 4
Fire Extinguishers (Fire extinguishers are available and well maintained to allow personnel fire suppression actions). *Fire Extinguishers*	The fire extinguishers can be used to prevent a small fire from propagating into a large fire in the waste storage areas.	✓			SC-1/2	AC 5.7	Facility Fire Scenarios 1, 2, 3, and 4
Interior Fire Barrier / Building Structure (Office area fires are prevented from propagating to waste storage areas by a combination of fire barriers and fire doors). *Office Area to Waste Area Fire Doors*	The wall between the Building 991 office area and Room 134 is considered a fire rated wall. The fire doors that separate the office area from the storage area are also considered part of this fire barrier. This interior fire barrier prevents hot gases from a fire in the office area involving waste containers in the storage area.	✓			SC-1/2	Design Feature	B-FFIRE-1

Table 6-1 Matrix of Building 991 Controls, Safety Features, and TSR Control

Control	Safety Feature	Control Feature[1]			Control Type	TSR Control	Accident Scenario
		PS	DID	WS			
Flow Alarm / Fire Department Response (Actuation of the automatic sprinkler systems will yield a flow alarm at the Fire Dispatch Center and will result in Fire Department response). *Flow Alarms/Fire Department Response*	The safety function of the flow alarm is to provide an alarm to the CAS and FDC to indicate a fire in sprinklered areas of Building 991. Receipt of the alarm will provide notification to the Fire Department, initiating Fire Department response to extinguish the fire and mitigate any fire related impacts.		✓		SC1/2	LCO 3.1	Facility Fire Scenarios 2 and 4
Smoke Detectors / Fire Department Response (Actuation of the smoke detection system will yield an alarm at the Fire Dispatch Center and will result in Fire Department Response ***Smoke Detectors/Fire Department Response***	The safety function of the smoke detectors is to provide a system to detect and report fires in non-sprinklered waste storage areas of the Building 991 Complex to facilitate response of the Fire Department. Receipt of the alarm will provide notification to the Fire Department, initiating Fire Department response to extinguish the fire and mitigate any fire related impacts.		✓		SC-1/2	LCO 3.1	Facility Fire Scenario 2
Filtered Exhaust Ventilation (Building 991 filtered exhaust ventilation is directly applied to the north waste container storage areas and indirectly applied to the south waste container storage areas other than Room 166). ***Building 991 Filtered Exhaust Ventilation System***	The safety function of the HEPA filtration system in Building 991 is to provide HEPA filtration of exhaust ventilation from the complex waste storage areas to reduce the consequences to the MOI and CW.	✓	✓		SC-1/2	LCO 3.2	Dominant Facility Fire Scenarios 1 and 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1
Filtered Exhaust Ventilation (Building 985 filtered exhaust ventilation is directly applied to some north waste container storage areas when the ventilation system is being used). *Building 985 Filtered Exhaust*	The safety function of the HEPA filtration system in Building 985 is to provide HEPA filtration of exhaust ventilation from some complex waste storage areas to reduce the consequences to the MOI and CW. This system is only needed if the Building 985 ventilation system is intended to be used.	✓			SC-1/2	LCO 3.2	Dominant Facility Fire Scenarios 1 and 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1

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Table 6-1 Matrix of Building 991 Controls, Safety Features, and TSR Control

Control	Safety Feature	Control Feature[1]			Control Type	TSR Control	Accident Scenario
		PS	DID	WS			
Exterior Walls and Concrete Roofs / Building Structure	The safety function of the exterior walls is to reduce the impact on radioactive waste containers from structural impacts caused by NPH/EE. These include high winds, tornadoes, wind driven missiles, atmospheric pressure changes, heavy rain, heavy snow, aircraft crash, and seismic event less than BDBE.	✓	✓	✓	SC-1/2	Design Feature	NPH/EE Accident Scenario Bounding Discussion
Fire Phones/Fire Department Response (Fire phone communication to the Fire Dispatch Center can lead to scenario mitigation due to Fire Department response).	The fire phones provide direct communication with the Fire Department to facilitate prompt response by the Fire Department to minimize the duration of a fire in the waste storage area.		✓		SC-3	AC 5.4	Facility Fire Scenarios 1, 2, 3, and 4
Smoke Detectors / LS/DW System (For fires in areas covered by smoke detectors, once informed by the Fire Department, facility management can utilize the LS/DW system to reduce IW consequences by providing indication of a fire to facility personnel).	The smoke detectors provide a system to detect and report fires in non-sprinklered waste storage areas of the Building 991 Complex to facilitate response of the Fire Department. Receipt of the alarm at the CAS and FDC will also facilitate initiation of an LS/DW announcement to notify personnel inside Building 991 of the fire.		✓	✓	SC-3	LCO 3.1 AC 5.4	Facility Fire Scenario 1
Fire Phones / Local Fire Alarm (Fire phone use activates local fire alarms and can reduce IW consequences by providing indication of a fire to facility personnel).	The fire phones provide an alarm (fire bells inside the building) indicating a fire to notify personnel inside Building 991 of a fire.		✓	✓	SC-3	AC 5.4	Facility Fire Scenarios 1, 2, 3, and 4 Facility Explosion Scenario 1
Water Gong Alarm / Automatic Sprinklers (Water gong alarm activation following automatic sprinkler system actuation may reduce IW consequences by providing indication of an explosion/fire to some facility personnel).	The safety function of the water gong alarms is to provide an alarm indicating activation of the automatic sprinklers and notifying personnel immediately outside of Building 991 of a fire.		✓	✓	SC-3	LCO 3.1 AC 5.4	Facility Fire Scenarios 1, 2, and 3 Facility Explosion Scenario 1

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Table 6-1 Matrix of Building 991 Controls, Safety Features, and TSR Control

Control	Safety Feature	Control Feature[1]			Control Type	TSR Control	Accident Scenario
		PS	DID	WS			
Water Gong Alarm (Water gong alarm activation following breach of the automatic sprinkler system piping from the floor collapse may reduce IW consequences by providing indication of the event to some facility personnel).	The safety function of the water gong alarms is to provide an alarm indicating activation of the automatic sprinklers and notifying personnel immediately outside of Building 991 of a potential problem in the building.		✓	✓	SC-3	AC 5.4	Spill Scenario 2
LS/DW (Facility management or other personnel can utilize the LS/DW system to reduce IW consequences by providing indication of fires, spills, and explosions to facility personnel).	Provides notification to building occupants in the event of fire, airborne contamination, and Site or building emergency response activities.		✓	✓	SC-3	AC 5.4	Facility Fire Scenario 3 Spill Scenarios 1 and 2 Puncture Scenario 1 Container Explosion Scenario 1 Facility Explosion Scenario 1
Flow Alarm / LS/DW (The flow alarm of the automatic sprinkler system could be initiated due to damage to the sprinkler system piping from the floor collapse that would notify the Fire Dispatch Center of the event. Once informed by the Fire Department, facility management can utilize the LS/DW system to reduce IW consequences by providing indication of an event requiring evacuation).	The flow alarm provides an alarm to the CAS and FDC to indicate flow of water in the automatic sprinkler system of Building 991. Receipt of the alarm at the CAS and FDC will also facilitate initiation of an LS/DW announcement to notify personnel inside Building 991 of the event.		✓	✓	SC-3	LCO 3.1 AC 5.4	Spill Scenario 2
Automatic Plenum Deluge Systems	The safety function of the plenum deluge systems is to reduce the likelihood of filter stage failure in the exhaust ventilation systems plenums due to filter ignition and burning.		✓		SC-3	LCO 3.3	Dominant Facility Fire Scenario 1

Table 6-1 Matrix of Building 991 Controls, Safety Features, and TSR Control

Control	Safety Feature	Control Feature[1]			Control Type	TSR Control	Accident Scenario
		PS	DID	WS			
Automatic sprinkler system portion in non-waste storage areas of the Building 991 Complex (Rooms 130, 137, 138, 156, 157, and 160-165 of Building 991, Building 989, and Building 985).	Provide protection of personnel and equipment in non-waste storage areas of the building.			✓	SC-3	LCO 3.1	B-FFIRE-1
Hallway floor (Room 153) loading capacity / Building Structure	The safety function of the hallway floor is to reduce the possibility of structural collapse of the floor caused by exceeding the load capacity of the floor resulting in a spill of radioactive material.		✓	✓	SC-1/2	Design Feature	Spill Scenario 2

[1]PS (Public Safety), DID (Defense in depth feature), WS (worker safety feature)

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6.4 ADMINISTRATIVE CONTROLS

6.4.1 Introduction

This section identifies the administrative controls that ensure administrative safety functions necessary for safe facility operation. It builds upon the identification in the hazard and accident analyses of the preventive and mitigative administrative safety features necessary to protect the public, CW, IW, and the environment, or that provide significant elements of defense-in-depth. This section also identifies the administrative controls that ensure the administrative safety features identified in the hazard and accident analyses, including those applicable to all postulated accident scenarios (i.e., assumed initial conditions). The administrative controls identified are contained in *Appendix A, Building 991 Complex Technical Safety Requirements* of the FSAR.

6.4.2 Identification of Administrative Controls

The safety analysis assumptions, features, and requirements section of the hazard and accident analyses in NSTR-011-98 identifies the administrative safety features considered significant for the Building 991 Complex. These assumptions, features, and requirements provide the broad set of administrative controls considered for accident prevention and/or mitigation, and from which the safety features specifically credited for reducing the risk of an accident to acceptable levels are derived. The administrative controls providing these safety features are captured by Table 6-2.

Table 6-2 correlates administrative safety features identified in the hazard and accident analyses to the administrative controls ensuring the conduct of those safety functions. The first column of the table presents the credited administrative control as derived from the safety analysis assumptions, features, and requirements. The Scenario Code column provides a cross-reference to the scenario in which each administrative control is applied (the control could have been identified in the hazard evaluation, the bounding accident scenario discussion, and/or the accident analysis). Italicized entries in the Scenario Code column indicate that the scenario summary table does not list the control but that the control is utilized in the determination of bounding scenarios (*e.g.*, a LLW container limit control is not listed for scenarios evaluating TRU waste containers but the LLW limit maintains the TRU waste bounding assumptions). The third column provides a cross-reference to the TSR administrative control (provided in Appendix A) that references the control. This column identifies the specific Administrative Operating Limit (AOL) in the TSR ACs. The final column identifies the safety feature of the credited administrative control and the presents the TSR AC wording for the control.

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Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
LLW containers contain no more than 0.5 grams (WG Pu equivalent) in metal drums and 3 grams in wooden or metal boxes. ***Container Radioactive Material Loading***	*Facility Fire Scenarios 1 and 2* Facility Fire Scenarios 3 and 4 *Spill Scenarios 1 and 2* Puncture Scenario 1 *Facility Explosion Scenario 1* *NPH/EE Scenarios 1, 2, and 3*	AC 5.2, AOL 4	Sets the potential MAR for many scenarios impacting LLW containers (3 grams for spills, punctures, and criticality potential). / The quantities of radioactive material in LLW drums and LLW crates received at and stored in the complex shall not exceed 0.5 grams (WG Pu equivalent) and 3 grams (WG Pu equivalent), respectively.
TRU waste containers contain no more than 200 grams (WG Pu equivalent) in metal drums and 320 grams in metal boxes. ***Container Radioactive Material Loading***	Facility Fire Scenarios 1 and 2 Spill Scenarios 1 and 2 Puncture Scenario 1 Container Explosion Scenario 1 Facility Explosion Scenario 1 NPH/EE Scenarios 1, 2, and 3	AC 5.2, AOL 4	Sets the potential MAR for many scenarios impacting waste containers (200 grams for facility fires and container explosions; 320 grams for facility fires, spills, punctures, container explosions, and criticality potential). / The quantities of radioactive material in TRU waste drums and TRU waste crates received at and stored in the complex shall not exceed 200 grams (WG Pu equivalent) and 320 grams (WG Pu equivalent), respectively.
POC containers contain no more than 1,255 grams (WG Pu equivalent) in metal drums and 200 grams (fissile material) in metal drums. ***Container Radioactive Material Loading***	Puncture Scenario 1	AC 5.2, AOL 4	Sets the potential MAR for many scenarios impacting POC containers (1,255 grams for facility fires and container explosions). / The quantities of radioactive material in POC containers received at and stored in the complex shall not exceed either 1,255 grams (WG Pu equivalent) or 200 grams (or Criticality Safety approved amount) fissionable material.
Type B containers cannot be impacted by activities other than the SNM and SURV activities due to their storage location and safeguards restrictions. ***SNM Only Staged in Vaults***	*Puncture Scenario 1*	AC 5.2, AOL 2	Defines the potential interactions and corresponding types of containers for many scenarios. / SNM containers shall only be staged in vaults in the complex.
Type B shipping containers, POC containers, and TRU waste containers will not be opened in the Building 991 Complex. *Containers Not Opened*	generally applied	AC 5.2, AOL 8	Defines the potential interactions for many scenarios. / Type B shipping containers, POC containers, and TRU waste containers shall not be opened in the complex.

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Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
TRU waste containers contain no more than 200 grams of fissionable material in drums. ***Container Fissionable Material Loading***	B-CRIT-1 B-CRIT-2	AC 5.2, AOL 6	Sets the potential MAR for criticality events involving TRU waste containers. SNM, POC, and waste containers received at, stored in, and staged in the complex shall be compliant with all requirements specified in the Criticality Safety Evaluation for the complex.
Pyrophoric materials (e.g., uranium fines) are not introduced into the facility under the WASTE activity. ***No TRU Pyrophoric***	MFIRE-1-WASTE, SURV, CHEM, CON, MAINT MFIRE-2-WASTE, SURV, CHEM, CON, MAINT MFIRE-3-WASTE MFIRE-4-WASTE, CON, MAINT MFIRE-5-GEN, WASTE, SURV, CHEM, CON, MAINT, RA MFIRE-6-WASTE, SURV, CHEM, CON, MAINT MFIRE-7-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA MFIRE-8-WASTE	AC 5.2, AOL 8	Reduces the likelihood of pyrophoric material waste container failure from direct interaction scenarios or indirect equipment impact scenarios to *Beyond Extremely Unlikely*. Pyrophoric material waste containers are prohibited from the complex.
A drop/fall of banded TRU or low-level waste containers results in the equivalent release of material of one waste container. ***Banding***	Spill Scenario 1 NPH/EE Scenario 2	AC 5.2, AOL 7	Sets the potential MAR for the scenario impacting TRU or low-level waste containers. All pallets of waste containers that are stacked to a third or fourth tier shall be banded.
Type B shipping containers cannot be breached by falls from any heights expected during operation. ***Type B Shipping Container***	MFIRE-1-SNM, SURV SPILL-1-SNM, SURV CRIT-2-SNM, SURV *Spill Scenario 1* *NPH/EE Scenario 2*	AC 5.2, AOL 2	Reduces the likelihood of Type B shipping container failure from scenarios dealing with dropped containers to *Beyond Extremely Unlikely*. SNM containers staged in the complex shall meet Type B shipping container certification.

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Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
POC containers cannot be breached by falls from any heights expected during operation. *POC Container*	SPILL-1-WASTE, SURV, CHEM, CON, MAINT SPILL-4-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA *Spill Scenario 1* *NPH/EE Scenario 2*	AC 5.2, AOL 1	Reduces the likelihood of POC container failure from scenarios dealing with dropped containers to *Beyond Extremely Unlikely*. / POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Metal waste containers are *unlikely* to be breached by non-forklift tine impacts from material handling equipment expected during operation. *Metal Waste Container*	MFIRE-2-WASTE, SURV, CHEM, CON, MAINT SPILL-2-GEN, WASTE, SURV, CHEM, CON, MAINT B-SPILL-1 Spill Scenarios 1 and 2	AC 5.2, AOL 1	Reduces the likelihood of metal waste container failure for scenarios dealing with material handling equipment impacts with containers, other than forklift tine puncture scenarios, by one frequency bin. / POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Type B shipping containers cannot be breached by material handling equipment impacts expected during operation. *Type B Shipping Container*	MFIRE-2-SNM, SURV SPILL-2-SNM, SURV CRIT-3-SNM, SURV	AC 5.2, AOL 2	Reduces the likelihood of Type B shipping container failure from scenarios dealing with material handling equipment impacts with containers to *Beyond Extremely Unlikely*. / SNM containers staged in the complex shall meet Type B shipping container certification.
POC containers cannot be breached by material handling equipment impacts expected during operation. *POC Container*	SPILL-2-WASTE, SURV, CHEM, CON, MAINT	AC 5.2, AOL 1	Reduces the likelihood of POC container failure from scenarios dealing with material handling equipment impacts with containers to *Beyond Extremely Unlikely*. / POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.

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Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Type B shipping containers are *unlikely* to be breached by structural member impacts due to impact angle requirements and weight needed to lead to failure. ***Type B Shipping Container***	MFIRE-3-SNM MFIRE-8-SNM SPILL-3-SNM PUNCT-3-SNM CRIT-4-SNM SPILL-3-SNM [aircraft crash] PUNCT-3-SNM [aircraft crash] CRIT-4-SNM [aircraft crash] B-CRIT-1 *NPH/EE Scenarios 1 and 2*	AC 5.2, AOL 2	Reduces the likelihood of Type B shipping container failure for scenarios dealing with structural members impacting containers by one frequency bin. SNM containers staged in the complex shall meet Type B shipping container certification.
POC containers are *unlikely* to be breached by structural member impacts due to impact angle requirements and weight needed to lead to failure. ***POC Container***	SPILL-3-WASTE PUNCT-3-WASTE CRIT-4-WASTE SPILL-3-WASTE [aircraft crash] PUNCT-3-WASTE [aircraft crash] CRIT-4-WASTE [aircraft crash] B-SPILL-2 B-PUNCT-2 B-CRIT-1 *Spill Scenario 2* *NPH/EE Scenarios 1, 2, and 3*	AC 5.2, AOL 1	Reduces the likelihood of POC container failure for scenarios dealing with structural members impacting containers by one frequency bin. POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Type B shipping containers cannot be breached by any external flammable gas explosions expected during operation. ***Type B Shipping Container***	MFIRE-4-SNM FEXPLO-1-SNM CRIT-5-SNM *Facility Explosion Scenario 1*	AC 5.2, AOL 2	Reduces the likelihood of Type B shipping container failure from scenarios dealing with natural gas or propane explosions to *Beyond Extremely Unlikely*. SNM containers staged in the complex shall meet Type B shipping container certification.

Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
POC containers cannot be breached by any external flammable gas explosions expected during operation. *POC Container*	FEXPLO-1-WASTE, CON, MAINT CRIT-5-WASTE, CON, MAINT B-FEXPLO-1 B-CRIT-2 *Facility Explosion Scenario 1*	AC 5.2, AOL 1	Reduces the likelihood of POC container failure from scenarios dealing with natural gas or propane explosions to *Beyond Extremely Unlikely*. POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Metal waste containers are *unlikely* to be breached by forklift tine impacts due to impact angle requirements needed to lead to failure and waste packaging. *Metal Waste Container*	MFIRE-6-WASTE, SURV, CHEM, CON, MAINT MFIRE-7-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA PUNCT-1-GEN, WASTE, SURV, CHEM, CON, MAINT PUNCT-2-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA B-PUNCT-1 Puncture Scenario 1	AC 5.2, AOL 1	Reduces the likelihood of metal waste container failure for scenarios dealing with forklift tines impacting containers by one frequency bin. POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Type B shipping containers are *extremely unlikely* to be breached by forklift tine impacts due to impact angle requirements needed to lead to failure and SNM packaging. *Type B Shipping Container*	MFIRE-6-SNM, SURV PUNCT-1-SNM, SURV B-PUNCT-1 Puncture Scenario 1	AC 5.2, AOL 2	Reduces the likelihood of Type B shipping container failure for *scenarios dealing with forklift tines impacting containers by two* frequency bins. SNM containers staged in the complex shall meet Type B shipping container certification.
POC containers are *extremely unlikely* to be breached by forklift tine impacts due to impact angle requirements needed to lead to failure and waste packaging. *POC Container*	PUNCT-1-WASTE, SURV, CHEM, CON, MAINT PUNCT-2-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA B-PUNCT-1 Puncture Scenario 1	AC 5.2, AOL 1	Reduces the likelihood of POC container failure for scenarios dealing with forklift tines impacting containers by two frequency bins. POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.

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Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Metal waste containers are *extremely unlikely* to be breached by internal hydrogen explosions due to metal waste container venting. ***Waste Container Vents***	CEXPLO-1-GEN, SNM, WASTE, SURV, CHEM, CON, MAINT, RA B-CEXPLO-1 Container Explosion Scenario 1	AC 5.2, AOL 3	Reduces the likelihood of metal waste container failure for scenarios dealing with internal hydrogen explosions by two frequency bins. Metal waste containers received at and stored in the complex shall be vented.
POC containers cannot be breached by any potential internal hydrogen explosions. ***POC Container***	CEXPLO-1-WASTE, SURV *Container Explosion Scenario 1*	AC 5.2, AOL 1	Reduces the likelihood of POC container failure from scenarios dealing with internal hydrogen explosions to *Beyond Extremely Unlikely*. POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Type B shipping containers cannot be breached by any external fires expected during operation, except direct flame impingement torch fires. ***Type B Shipping Container***	FFIRE-2-SNM FFIRE-3-SNM B-FFIRE-1 *Facility Fire Scenarios 1 and 2*	AC 5.2, AOL 2	Reduces the likelihood of Type B shipping container failure from scenarios dealing with facility fires, other than direct flame impingement torch fires, to *Beyond Extremely Unlikely*. SNM containers staged in the complex shall meet Type B shipping container certification.
POC containers cannot be breached by any external fires expected during operation, except direct flame impingement torch fires. ***POC Container***	FFIRE-2-WASTE FFIRE-3-WASTE, CHEM, CON, MAINT, RA B-FFIRE-1 *Facility Fire Scenarios 1 and 2*	AC 5.2, AOL 1	Reduces the likelihood of POC container failure from scenarios dealing with facility fires, other than direct flame impingement torch fires, to *Beyond Extremely Unlikely*. POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.

Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Flammable gas containers are *unlikely* to be breached during use. ***Flammable Gas Container***	FFIRE-3-CON, MAINT FFIRE-4-CON, MAINT FEXPLO-1-CON, MAINT FEXPLO-2-CON, MAINT CRIT-5-CON, MAINT B-FFIRE-3 B-FEXPLO-1 B-CRIT-2 Facility Fire Scenarios 1, 2, 3, and 4 Facility Explosion Scenario 1	AC 5.3, AOL 10	Reduces the likelihood of explosion or fire scenarios due to use of flammable gases by one frequency bin. / Flammable gas containers shall meet DOT requirements.
Metal waste container lids cannot be removed from the containers due to internal overpressurize from exposure to expected fires. ***Metal Waste Container***	Facility Fire Scenarios 1 and 2	AC 5.2, AOL 1	Reduces the likelihood of metal waste container fire-induced lid loss associated with expected fires to *Beyond Extremely Unlikely*. / POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Metal waste container fires cannot propagate from container to container by exposure to expected fires. ***Metal Waste Container***	Facility Fire Scenarios 1 and 2	AC 5.2, AOL 1	Reduces the likelihood of metal waste container fire container-to-container propagation associated with expected fires to *Beyond Extremely Unlikely*. / POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Wooden waste containers prevent direct exposure of fires to container contents for expected fires. ***Wooden Waste Container***	Facility Fire Scenarios 3 and 4	AC 5.2, AOL 1	In combination with ***wooden waste crate liners***, reduces the consequences from LLW crate fires by two orders of magnitude. / POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
TRU and low-level waste containers cannot be breached by falls less than four feet. ***Metal Waste Container***	B-CRIT-1 Spill Scenario 1 NPH/EE Scenarios 1, 2, and 3	AC 5.2, AOL 1	Reduces the likelihood of TRU and low-level waste container failure due to dropping from less than four feet to *Beyond Extremely Unlikely*. / POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.

Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Metal waste drums cannot be breached by an external explosion peak overpressure less than 22 psig. *Metal Waste Drum*	B-CRIT-2 Facility Explosion Scenario 1	AC 5.2, AOL 1	Limits the MAR associated with facility explosions to containers breached by falling debris versus direct explosion impacts. / POC and waste containers received at and stored in the complex shall meet on-site transportation requirements.
Stacking of Type B shipping containers is prohibited. *Type B Shipping Container Stacking Restriction*	MFIRE-5-SNM SPILL-4-SNM CRIT-6-SNM B-SPILL-1 *Spill Scenario 1* *NPH/EE Scenario 2*	AC 5.2, AOL 8	Reduces the likelihood of Type B shipping container spills associated with stack toppling to *Beyond Extremely Unlikely*. / Type B shipping containers shall not be stacked in staging area.
Propane or other flammable gases are prohibited from vaults while SNM is present. *Flammable Gas Prohibited in Vaults with SNM*	FFIRE-1-SNM B-FFIRE-3	AC 5.3, AOL 10	Reduces the likelihood of Type B shipping container breaches associated with direct flame impingement from torches to *Beyond Extremely Unlikely*. / Flammable gas shall not be used in vaults while SNM is present.
Work controls are required to ensure that waste container direct exposure to propane or other flammable gas flames is an *extremely unlikely* event. *Flammable Gas Not Near Containers*	FFIRE-1-WASTE, CON, MAINT B-FFIRE-1	AC 5.3, AOL 10	Reduces the likelihood of metal waste container failure from scenarios dealing with direct exposure to flammable gases (*i.e.*, torches) to *Extremely Unlikely*. / Flammable gas containers shall not be placed within five feet of radioactive material containers.
Type B shipping containers shall be designed and used in a manner to preclude a criticality as long as the containers remain intact. *Criticality Controls*	CRIT-1-SNM, SURV CRIT-2-SNM, SURV CRIT-3-SNM, SURV CRIT-7-SNM CRIT-8-SNM	AC 5.2, AOL 6	Reduces the likelihood of intact Type B shipping container criticalities to *Beyond Extremely Unlikely*. / SNM, POC, and waste containers received at, stored in, and staged in the complex shall be compliant with all requirements specified in the Criticality Safety Evaluation for the complex.

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Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Waste containers in the Building 991 Complex shall be designed and used in a manner to preclude a criticality as long as the containers remain intact. *Criticality Controls*	CRIT-1-WASTE, SURV, CHEM, CON, MAINT CRIT-7-WASTE CRIT-8-WASTE	AC 5.2, AOL 6	Reduces the likelihood of intact waste container criticalities to *Beyond Extremely Unlikely*. SNM, POC, and waste containers received at, stored in, and staged in the complex shall be compliant with all requirements specified in the Criticality Safety Evaluation for the complex.
A combustible material and ignition source control program shall be implemented to make fires in areas containing staged, stored, or in-process (*i.e.*, GEN activity) radioactive material *unlikely* events. Elements of combustible material control include: • high heat release rate combustible material restrictions; • no wooden crates in internal waste storage areas; • combustibles have five foot separation from waste containers. Elements of ignition source control include: • restrictions on smoking in facilities; • hot work permits. *Combustible Material Control* *Ignition Source Control*	FFIRE-3-GEN, SNM, WASTE, CHEM, CON, MAINT, RA FFIRE-4-GEN, WASTE, CHEM, CON, MAINT, RA B-FFIRE-3 Facility Fire Scenarios 1, 2, 3, and 4 NPH/EE Scenarios 1 and 2	AC 5.3, AOL 9	Reduces the likelihood of facility fires potentially impacting radioactive material to *Unlikely*. A combustible material and ignition source control program shall be implemented in the complex; 1) flammable/combustible liquids shall not be stored outside NFPA approved cabinets; quantities of flammable/combustible liquids in excess or 2 gallons shall not be located in waste container storage areas without proper containment/confinement; *quantities of plastic material which would yield more than* 2 gallons of material when melted shall not be located in waste container storage areas without proper containment/ confinement; fossil-fueled material handling vehicles shall not be used in interior waste container storage areas; 2) no wooden crates shall be permitted in interior waste container storage areas; 3) combustible materials shall remain separated from waste containers by at least five feet; 4) smoking shall not be permitted inside facilities containing waste container storage areas; and 5) hot work shall be controlled by a permitting process.
A hot work control program shall be implemented to make flammable gas explosions in areas containing staged, stored, or in-process (*i.e.*, GEN activity) radioactive material *unlikely* events. *Hot Work Control*	FEXPLO-1-CON, MAINT FEXPLO-2-CON, MAINT CRIT-5-CON, MAINT B-FEXPLO-1 B-CRIT-2 Facility Explosion Scenario 1	AC 5.3, AOL 9	Reduces the likelihood of facility explosions potentially impacting radioactive material by one frequency bin. Hot work shall be controlled by a permitting process; flammable gas containers shall not be stored in the complex.

Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Type B shipping containers received at Building 991 shall meet the requirements of 1-W89-HSP-31.11. *Container Radioactive Material Loading*	MFIRE-3-SNM MFIRE-6-SNM, SURV MFIRE-8-SNM	AC 5.2, AOL 2	Reduces the likelihood of a Type B shipping container containing pyrophoric material to *unlikely*. / SNM containers staged in the complex shall meet Type B shipping container certification.
The Building 991 Complex will develop an Emergency Plan for the facilities in the complex. *Emergency Plan*	Facility Fire Scenarios 1, 2, 3, and 4 Spill Scenarios 1 and 2 Puncture Scenario 1 Container Explosion Scenario 1 NPH/EE Scenario 3	AC 5.5	Reduces the exposure of the IW to releases. / A program shall be established, implemented, and maintained for emergency response.
Electrical systems in the Building 991 Complex are maintained sufficiently to prevent fires from hot shorts becoming *anticipated* events. *Electrical System Maintenance*	Facility Fire Scenarios 1, 2, 3, and 4	AC 5.6, SMP Maintenance	Reduces the likelihood of fires from electrical system failures to ***unlikely*** or ***extremely unlikely*** events. / The SMPs (including Maintenance), as described and graded in Chapter 3 of the FSAR shall be maintained to provide worker protection and defense-in-depth safety functions.
All wooden LLW crates stored in the Building 991 Complex shall have liners. *Wooden Waste Crate Liners*	Facility Fire Scenarios 3 and 4	AC 5.2, AOL 1	In combination with ***wooden waste container***, reduces the consequences from LLW crate fires by two orders of magnitude. / Wooden LLW crates received at and stored in the complex shall contain plastic liners per Site procedures.
No more than 50 wooden LLW crates may be stored in the West Dock Canopy waste storage area. *50 Wooden LLW Crate Limit*	Facility Fire Scenario 4	AC 5.2, AOL 5	Limits the consequences from major LLW crate fires. / No more than 50 wooden LLW crates may be stored at the complex.
Storage of waste containers in Corridor C is prohibited. *Storage of Waste Containers in Corridor C Prohibited*	B-CRIT-1 *Spill Scenario 2*	AC 5.2, AOL 8	Eliminated analysis of structural failure of the corridor and its potential impact on the MOI, CW, and IW. / Waste containers shall not be stored in Corridor C.

Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Waste containers stacked above the second tier will be banded. *Banding*	Spill Scenario 1 NPH/EE Scenario 2	AC 5.2, AOL 7	Reduces the effective MAR of the scenario due to a pallet of TRU waste container dropping or falling from the third or fourth tier of the stack. / All pallets of waste containers that are stacked to a thrid or fourth tier shall be banded.
The Building 991 Complex will comply with Radiation Protection program guidance. *Radiation Protection*	Spill Scenarios 1 and 2 Puncture Scenario 1	AC 5.6, SMP Radiation Protection	Reduces the exposure to the IW to releases. / The SMPs (including Radiation Protection), as described and graded in Chapter 3 of the FSAR shall be maintained to provide worker protection and defense-in-depth safety functions.
Waste containers to be stored in the Building 991 Complex shall not contain liquids. *Liquids in Waste Prohibited*	Container Explosion Scenario 1	AC 5.2, AOL 8 and AC 5.2, AOL 6	Reduces the likelihood of internal hydrogen explosions in containers by reducing the potential rate of hydrogen generation. / Waste containers shall not contain liquids that can lead to significant hydrogen generation and/or metal waste container vent plugging. and SNM, POC, and waste containers received at, stored in, and staged in the complex shall be compliant with all requirements specified in the Criticality Safety Evaluation for the complex.
The use of flammable gas in Room 135, Room 142, Room 143, Room 148, Room 158, and Building 996 is prohibited. ***Use of Flammable Gas in Room 135, Room 142, Room 143, Room 148, Room 158, and Building 996 is Prohibited***	B-FEXPLO-1 B-CRIT-2 Facility Explosion Scenario 1	AC 5.3, AOL 10	Limits the MAR associated with facility explosions to containers breached by falling debris versus direct explosion impacts. / Flammable gas containers shall not be taken into waste container storage area Room 135, Room 142, Room 143, Room 147, Room 148, Room 158, and Building 996.
The flammable gas inventory in Room 134, Room 140/141/153, Room 151, Room 155, Room 166, Room 170, and Building 998 shall be limited to 150 ft^3. *Flammable Gas Inventory*	B-CRIT-2 Facility Explosion Scenario 1	AC 5.2, AOL 10	Limits the MAR associated with facility explosions to containers breached by falling debris versus direct explosion impacts. / Flammable gas container (fully charged) contents shall not exceed a maximum gas volume of 150 cubic feet.

Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Room 166 can only be used to store POC containers; metal waste containers other than POC containers are prohibited from storage in Room 166 ***Restrict Room 166 Storage to POC Containers***	B-FEXPLO-1 B-CRIT-2 Dominant Facility Fire Scenarios 1 and 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	AC 5.2, AOL 8	In combination with the robustness of the *POC container*, reduces the likelihood of a natural gas explosion in Room 166 impacting radioactive materials to a *beyond extremely unlikely* event. / Only POCs shall be stored in Room 166.
Facility doors are configured in a manner to allow the north waste container storage area ventilation to ventilate the south waste container storage areas, other than Room 166. ***Building 991 Facility Configuration***	Dominant Facility Fire Scenarios 1 and 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	LCO 3.2 and AC 5.2, AOL 8	Reduces the radiological consequences to the collocated worker and the public from operationally induced facility fires, spills, punctures, and container explosions in the south waste container storage areas. / Differential pressure in Room 170 shall be ≥ 0.02 in. water gauge negative with respect to atmospheric reference. and To conduct operations in Rooms 134 and 135, other than movement of POCs, there must be an airflow connection between Room 134 and the north waste storage area.
Room 170 differential pressure with respect to atmosphere is verifiable. ***Room 170 Differential Pressure***	Dominant Facility Fire Scenarios 1 and 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	SR 4.2.4	Reduces the radiological consequences to the collocated worker and the public from operationally induced facility fires, spills, punctures, and container explosions in the south waste container storage areas. / Verify that the pressure differential in Room 170 is ≥ 0.02 in. water gauge negative with respect to atmospheric reference.
Operations in Rooms 147 and 170 are restricted while Room 170 dock doors are open. ***Rooms 147 and 170 Operations Restrictions***	Dominant Facility Fire Scenarios 1 and 2 Dominant Spill Scenario 1 Dominant Puncture Scenario 1 Dominant Container Explosion Scenario 1	AC 5.2, AOL 8	Reduces the radiological consequences to the collocated worker and the public from operationally induced facility fires, spills, punctures, and container explosions in the south waste container storage areas. / Operations, other than container receipt, container shipment, movement of SNM Type B shipping containers, and movement of POCs, shall not be conducted inside Rooms 147 and 170 when a Room 170 dock door is opened.

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Table 6-2 Credited Administrative Controls Matrix

CREDITED ADMINISTRATIVE CONTROL	SCENARIO CODE	TSR/SMP	SAFETY FEATURE / CONTROL WORDING
Containers may not be stacked above a second tier during Room 170 receipt and shipment operations. *No Stacking Above Second Tier While Dock Doors Open*	Dominant Spill Scenario 1	AC 5.2, AOL 8	Reduces the likelihood of operationally induced spills in Room 170 while dock doors are open. / Waste containers being received or staged for shipping shall not be stacked more than 2-high in Room 170.
Wooden LLW crate restrictions.	*Generally Applied to Facility Fires*	AC 5.2, AOL 5	Limits the quantity and location of wooden LLW crates in the evaluation of postulated facility fire accident scenarios. / Wooden LLW crates stored at the complex shall be located outside of buildings, shall be located in areas covered by the Automatic Sprinkler System, and shall be located in compliance with Fire Protection Program requirements.
Wooden pallet restrictions.	*Generally Applied to Facility Fires*	AC 5.3, AOL 9	Limits the amount of combustible material in waste container storage areas. / Wooden pallets shall not be used for waste container storage.
Combustible loading restrictions.	*Generally Applied to Facility Fires*	AC 5.3, AOL 9	Limits the amount of combustible material in waste container storage areas. / Combustible loading shall be maintained consistent with Fire Hazard Analysis categorization (*i.e.*, very limited combustibles in waste container storage areas).
Flammable gas container restrictions.	*Generally Applied to Facility Fires* *Generally Applied to Facility Explosions*	AC 5.3, AOL 9	Reduces the likelihood that flammable gas container explosion/fire could impact radioactive waste containers. / Flammable gas containers shall not be stored in the complex.

6.5 TSR DERIVATION

The TSRs were developed as a result of the hazard evaluation and accident analysis processes presented in NSTR-011-98 (Ref. 1). The process used to develop the TSRs is depicted in Figure 6-1. There are four inputs to the TSRs: (1) Recognized Controls, (2) Credited Controls, (3) Derived Controls, and (4) Site Management Controls as defined below.

Recognized Controls were identified during the hazard identification step of the safety analysis. Recognized controls helped to determine whether identified hazards could be characterized as *standard industrial hazards,* requiring no further evaluation, or as hazards requiring further evaluation. Recognized Controls are typically covered by the Safety Management Programs (SMPs) that enhance defense-in-depth and worker safety and are not usually driven by the individual accident scenario evaluations. Examples of Recognized Controls include drum handling equipment design and health and safety practices addressing control of such equipment.

Credited Controls are those controls specifically identified and credited during evaluation of postulated accident scenarios in NSTR-011-98. Credited Controls include LCOs (and associated SRs), Design Features, and ACs that support the accident scenario frequency and consequence assumptions presented in the accident analysis tables. Examples of Credited Controls include the Automatic Sprinkler System and control of combustible materials and ignition sources.

Derived Controls are any additional controls that were identified during evaluation of the risk dominant accident scenarios. Derived Controls further reduce the risk of the postulated accident scenarios from what is presented in the accident evaluation section. Derived Controls are similar to Credited Controls; the distinction between these types of controls deals with the point in the analysis where the control is defined. An example of a Derived Control is the Filtered Exhaust Ventilation System.

Finally, ***Site Management Controls*** help assure the continued implementation and maintenance of the TSRs. Examples of Site Management Controls include Organization and Management, Configuration Control, Quality Assurance, Records Management and Document Control, Training, and Nuclear Safety.

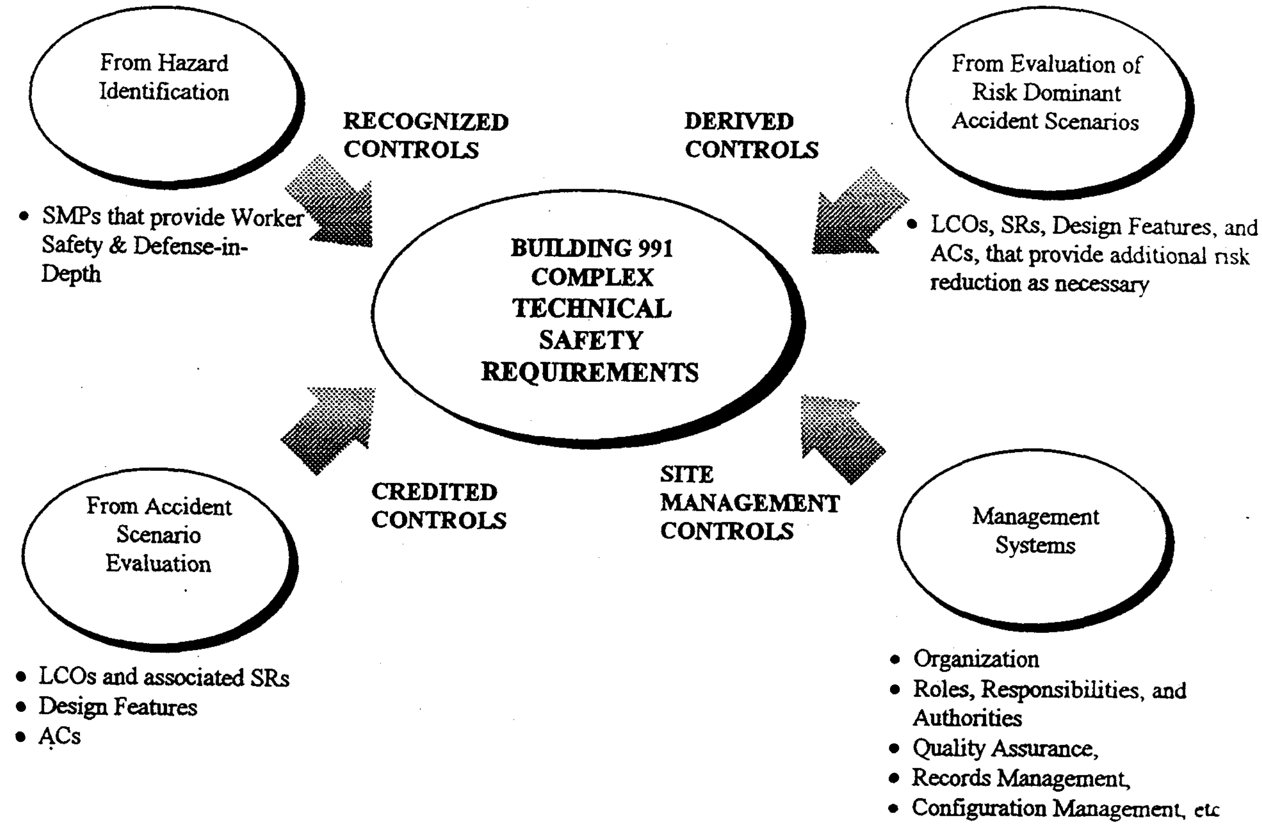

Figure 6-1 Development of Building 991 Complex Technical Safety Requirements

6.6 REFERENCES

1 *Safety Analysis for the Building 991 Complex Final Safety Analysis Report*, **NSTR-011-98**, Nuclear Safety Technical Report, Rocky Mountain Remediation Services, L.L.C., Revision 1, January 1999.

2 *Technical Safety Requirements*, **DOE Order 5480.22**, U. S. Department of Energy, Washington, DC, 1992.

3 *Document of Example Technical Safety Requirements, Volume I,* Defense Programs, U. S. Department of Energy, Washington, DC, November, 1993.

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CHAPTER 5

SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS

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5. SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS

5.1 INTRODUCTION

The objective of this chapter is to identify and classify those structures, systems, and components (SSCs) that ensure the functions necessary for safe facility operation. The preventive and mitigative safety features necessary to protect the maximum [exposed] off-site individual (MOI), the collocated worker (CW), the immediate worker (IW), and the environment, or to provide significant defense-in-depth functions, are identified in the hazard evaluation and accident analysis sections of NSTR-011-98, *Safety Analysis for the Building 991 Complex Final Safety Analysis Report* (Ref. 1). This chapter correlates those identified safety features to the Building 991 Complex SSCs capable of providing the necessary safety functions. This chapter then categorizes each of the safety SSCs according to their importance to safety and their operability requirements to perform their identified safety function.

Development of System Evaluation Reports (SERs) was not accomplished for the Building 991 Complex SSCs. Therefore, this chapter provides the safety functions of the SSCs, their boundaries, the support systems required to be operable so the safety SSCs maintain their safety functions, and the functional requirements of the SSCs (the acceptance criteria for each SSC, including surveillance requirements and frequencies, is detailed in Appendix A, *Building 991 Complex Technical Safety Requirements*). This information is presented in a tabular format. In most cases the system descriptions provided in Chapter 2 will suffice, therefore, this chapter will not provide additional SSC description information unless required to supplement the Chapter 2 information. The SSCs determined most significant for the safe operations of the facility are covered by Technical Safety Requirements (TSRs).

Safety SSCs for the Building 991 Complex are categorized in two ways to accommodate Site methodology and Department of Energy Standard 3009-94 (DOE-STD-3009) (Ref. 2) methodology. These two methodologies do not correlate with each other. The Site methodology provides System Category (SC) levels for the SSCs so procurement requirements can be specified. The Site methodology classifies SSCs as SC-1/2, SC-3, or SC-4 depending on their importance in protecting the MOI, CW, and IW. The DOE-STD-3009 methodology classifies SSCs as either safety-class or safety-significant depending on their importance of protecting the MOI and the environment, or if they are major contributors to defense-in-depth. Section 5.2 discusses categorization of the SSCs per the Site methodology and Section 5.3 discusses categorization of the SSCs per the DOE-STD-3009 methodology.

Safety SSCs were identified during three phases of the hazard evaluation and accident analysis process. The first phase was during the hazard evaluation process. This process qualitatively evaluated the hazards associated with the activities being conducted at the Building 991 Complex. Assumptions, protective features, and requirements were identified during this phase. These assumptions, protective features, and requirements could involve SSCs specifically credited to eliminate a potential accident scenario from further evaluation.

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The second phase for identifying safety SSCs occurred during the bounding scenario discussion for each accident type (i.e., facility fires, spills, punctures, container explosions, facility explosions, criticalities, and natural phenomena hazards / external events (NPH/EE)). SSCs could be specifically credited during this bounding scenario discussion that eliminated accident scenarios from further evaluation.

The third phase for identifying safety SSCs occurred during the accident scenario analysis. This phase provided the most quantitative analysis of potential accident scenarios for the Building 991 Complex. The accident analysis tables provided in NSTR-011-98, *Safety Analysis for the Building 991 Complex Final Safety Analysis Report*, identify the safety features considered significant for each of the accident scenarios analyzed. Those tables list these features in the "Protective Feature" column. These features represent the broad set of controls considered for accident prevention and/or mitigation, and from which the safety features specifically credited for reducing the risk of an accident to acceptable levels are derived. The primary credited safety features are indicated in the "Feature Type" column with a "C", while those providing defense-in-depth are indicated with a "D". The risk dominant accident scenario discussion provided in NSTR-011-98 and in Chapter 4 was also used to identify safety SSCs that could further reduce the risk of the risk dominant accident scenario.

5.2 SSC SYSTEM CATEGORY DESIGNATION

For Site system categorization purposes, safety SSCs for the Building 991 Complex are categorized into one of three SC levels as defined in procedure 1-V51-COEM-DES-210 (Ref. 3) and defined below.

- SC-1/2: Engineered safety features credited or designated in an approved authorization basis document that have been determined to be essential to protect the public and the collocated worker from radiological harm. These SSCs are directly relied upon to prevent or mitigate significant radiological releases. For design activities where Department of Energy (DOE) Order 6430.1A, *General Design Criteria* (Ref. 4), applies, those SSCs that meet the safety class criteria in Section 1300-3 of DOE Order 6430.1A. Also, those non-credited or non-designated engineered SSCs whose failure could potentially inhibit or prevent credited or designated SC-1/2 SSCs from performing their intended safety function are classified as SC-1/2.
- SC-3: SSCs that are relied upon for regulator-required worker protection from radiological or toxicological hazards.
- SC-4: SSCs that do not meet the requirements of SC-1/2 or SC-3.

The system categorization of safety SSCs recognizes the more significant safety role performed by SC-1/2 SSCs versus SC-3 SSCs. This difference in priority also applies to ensuring operational reliability. SC-1/2 SSCs typically require more stringent levels of surveillance and maintenance to ensure the highest level of operational reliability. SC-1/2 SSCs are typically surveilled, tested, and maintained to the standards defined in the Limiting

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Conditions for Operations (LCOs) in the TSRs (*e.g.*, automatic fire suppression system in waste storage areas and the office area). SC-1/2 SSCs are also subject to more stringent procurement quality standards than SC-3 SSCs.

The SC-3 SSCs are typically engineered and maintained in accordance with Administrative Controls (ACs) and Safety Management Programs (SMPs). Standards for the functionality of SC-3 SSCs generally derive from good industry practices and existing Site procedures. Absence of high reliability for a SC-3 SSC does not materially affect the risk profile of the building, given that it operates in accordance with the building TSRs. Designation of an SSC as a SC-3 SSC in the FSAR ensures that system functionality will be maintained commensurate with the system importance to safety, current configuration, and the barrier it poses to accident occurrence and/or consequence.

Table 5-1 correlates safety features identified in the hazard evaluation, bounding accident scenario discussion, accident analyses provided in NSTR-011-98, and the risk dominant accident scenario discussion, to safety SSCs performing the safety functions. Table 5-1 identifies the safety SSCs credited during the hazard evaluation and accident scenario analysis. The safety SSCs identified are those specifically credited with preventive or mitigative safety features, and those identified as providing a defense-in-depth safety function. The first column of Table 5-1 labeled as, "Protective Feature", lists the preventive and mitigative safety features from the NSTR-011-98 accident analysis tables or from the risk dominant accident scenario discussion for the postulated accident scenarios. The second column identifies the safety SSC providing the safety feature listed in the first column.

The third column of Table 5-1 provides the accident scenario type (*i.e.*, facility fires, spills, punctures, container (hydrogen) explosion, facility explosion, NPH/EE) identification of safety SSCs. The specific accident scenario (*e.g.*, Facility Fire 1) is provided if the SSC is listed in the accident scenario summary table. The "SC Designation" column indicates the level assigned to the SSC based on the safety function of the SSC. Those SSCs considered essential to protect the MOI or CW from radiological harm are identified as SC-1/2. Those SSCs relied on for regulator-required worker protection are identified as SC-3. If an SSC doesn't meet any of these criteria, it is identified as SC-4. The level indicated in the "SC Designation" column reflects the highest level of safety significance achieved by an SSC (*i.e.*, indicated levels are independent of safety significance to any one particular accident scenario). For example, the automatic sprinklers or automatic fire suppression portions of the Fire Suppression, Detection, and Alarm Systems are SC-1/2 because the systems perform a specifically credited safety function for the MOI and CW in at least one accident scenario analyzed. In contrast, the fire phones / Fire Department response are SC-3 because, although they provide defense-in-depth for MOI, CW, and IW; they are never specifically credited in the hazard evaluation and accident analyses for protection of the MOI and CW.

The "Comments" column provides a short explanation on the credited or defense-in-depth safety function of the safety SSC.

Table 5-1 provides the matrix relating safety features identified in the hazard and accident analyses to safety SSCs, and provides the system category (SC-1/2, SC-3, and SC-4) designation of the safety SSCs. Section 5.2.1, *SC-1/2 SSCs*, and Section 5.2.2, *SC-3 SSCs*, then identify the safety functions, system boundaries, support systems, and functional requirements for the applicable safety SSC.

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Table 5-1 System Category Designation of Safety SSCs

Protective Feature	**Safety-Related SSC**	**Accident Scenario Type**	**SC Designation**	**Comments**
Interior Fire Barrier (fire rated wall and fire doors separating office area from Room 134)	Building Structure	Facility Fires	SC-1/2	Credited with eliminating the potential of a large fire in the office area impacting waste containers in Room 134.
Exterior Walls and Concrete Roofs.	Building Structure	NPH/EE Events	SC-1/2	Credited with reducing the possibility that an aircraft crash could impact radioactive waste containers. The safety function of the building structure is to also reduce the possibility that NPH events could impact radioactive waste containers.
Hallway Floor Loading Capacity (Room 153)	Building Structure	Spill Scenario 2	SC-1/2	Credited with reducing the frequency of Room 153 floor collapse induced spills of waste containers.
Automatic Sprinklers	The automatic fire suppression portion of the Fire Suppression, Detection, and Alarm Systems	Facility Fires & Facility Fire Scenarios 1, 2, 3, 4	SC-1/2	Credited with controlling the size of fires possible in the waste storage areas. Also credited with eliminating the potential of a large fire in the office area impacting waste containers in Room 134.

Table 5-1 System Category Designation of Safety SSCs

Protective Feature	**Safety-Related SSC**	**Accident Scenario Type**	**SC Designation**	**Comments**
Flow Alarm / Fire Department Response	The fire detection and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenarios 2, 4	SC-1/2	The safety function of the flow alarms is to notify the Fire Department of a fire in Building 991 waste storage areas (other than Building 996 and Corridor B). The flow alarms are specifically credited to mitigate potential fires larger than those evaluated in NSTR-011-98.
Smoke Detectors / Fire Department Response	The fire detection and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenario 2	SC-1/2	The safety function of the smoke detectors is to notify the Fire Department of a fire in Building 996 or Corridor B. The smoke detectors are specifically credited to mitigate potential fires larger than those evaluated in NSTR-011-98.
Fire Extinguishers	The fire extinguishers located throughout the facility	Facility Fire Scenarios 1, 2, 3, 4	SC-1/2	The fire extinguishers are credited with preventing a small fire from propagating into a larger fire.
Fire Phones / Fire Department Response	The fire detection and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenarios 1, 2, 3, 4	SC-3	The fire phones provide a means to notify the Fire Department of a fire in the Building 991 Complex.
Fire Phones / Local Fire Alarm	The fire alarm portion of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenarios 1, 2, 3, 4 & Facility Explosion Scenario 1	SC-3	The fire phones provide an alarm to notify personnel inside Building 991 of a fire or other type of incident.

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Table 5-1 System Category Designation of Safety SSCs

Protective Feature	Safety-Related SSC	Accident Scenario Type	SC Designation	Comments
LS/DW	The vocal announcement portion of the LS/DW System	Facility Fire Scenario 3 & Spill Scenarios 1, 2 & Puncture Scenario 1 & Container Explosion Scenario 1 & Facility Explosion Scenario 1	SC-3	Provides notification to building occupants in the event of fire, airborne contamination, and Site or building emergency response activities.
Building 991 Filtered Exhaust	The filtered exhaust ventilation portion of the Building 991 Heating, Ventilating, and Air Conditioning (HVAC) System	Dominant Facility Fire Scenarios 1, 2 & Dominant Spill Scenario 1 & Dominant Puncture Scenario 1[1] & Dominant Container Explosion Scenario 1[1]	SC-1/2	The filtered exhaust ventilation system provides protection to the MOI and the CW from radiological harm as discussed in the Risk Dominant Accident Scenario section.
Building 985 Filtered Exhaust (if the ventilation system is intended to be used)	The filtered exhaust ventilation portion of the Building 985 HVAC System	Dominant Facility Fire Scenarios 1, 2 & Dominant Spill Scenario 1 & Dominant Puncture Scenario 1 & Dominant Container Explosion Scenario 1	SC-1/2	The filtered exhaust ventilation system provides protection to the MOI and the CW from radiological harm as discussed in the Risk Dominant Accident Scenario section.

[1] - The filtered exhaust ventilation system can only be credited if the West Dock doors are closed. This event is just as likely to occur when the dock doors are open.

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Table 5-1 System Category Designation of Safety SSCs

Protective Feature	Safety-Related SSC	Accident Scenario Type	SC Designation	Comments
Water Gong Alarm / Automatic Sprinklers	The automatic fire suppression and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenarios 1, 2, 3 & Facility Explosion Scenario 1	SC-3	Provides indication of automatic sprinkler system activation to notify personnel outside of Building 991.
Water Gong Alarm	The alarm portion of the Fire Suppression, Detection, and Alarm Systems	Spill Scenarios 2	SC-3	Provides indication of automatic sprinkler system pipe failure following floor collapse to notify personnel outside of Building 991.
Automatic Plenum Deluge	The automatic fire suppression portion of the Fire Suppression, Detection, and Alarm Systems	Dominant Facility Fire Scenario 2	SC-3	Provides a defense-in-depth safety function for the filtered exhaust ventilation systems.
Flow Alarm / LS/DW	The fire alarm portion of the Fire Suppression, Detection, and Alarm Systems and the vocal announcement portion of the LS/DW System	Spill Scenario 2	SC-3	Receipt of the flow alarm at the CAS and FDC will facilitate initiation of an LS/DW announcement to notify personnel inside Building 991 of an incident.
Smoke Detectors / LS/DW	The fire detection and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems and the vocal announcement portion of the LS/DW System	Facility Fire Scenario 1	SC-3	Receipt of the alarm from the smoke detectors at the CAS and FDC will facilitate initiation of an LS/DW announcement to notify personnel inside Building 991 of the fire.

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5.2.1 SC-1/2 SSCs

This section summarizes the safety functions, boundaries, support systems, functional requirements, and TSR implementation linkage for those SSCs specifically credited in the accident analysis as providing necessary safety functions to protect the MOI and CW from radiological harm. These SSCs are designated SC-1/2 SSCs as shown in Table 5-1. The following systems were identified as SC-1/2 SSCs.

- Fire Suppression, Detection, and Alarm System (automatic sprinkler system, flow alarms/Fire Department response, smoke detectors/Fire Department response, and fire extinguishers).
- Building structure (interior fire barrier (wall and fire doors separating office area from Room 134); exterior walls and concrete roofs; Room 153 floor) (passive design features).
- Heating, Ventilating, and Air Conditioning System (filtered exhaust ventilation provided by the Building 991 roof plenum and by the Building 985 plenum (if intended to be used)).

Table 5-2 provides a matrix of the Building 991 Complex SC-1/2 SSCs. Column 1 of the table identifies the SSC identified as a SC-1/2 SSC and the specific attributes of that SSC that make it a SC-1/2 SSC. The "Safety Function" column of the table provides the reason for designating the SSC as a SC-1/2 SSC. This column specifically identifies the safety function credited in the safety analysis. Non-safety functions are not provided in this column. If the accident analysis requires that the SSC be relied on to operate after a natural phenomena hazard (NPH) event, that function will be identified in this column. The "Boundaries" column of the table identifies the specific portions of the SSC that are being relied upon in the accident analysis. This column attempts to be specific in the portions of the SC-1/2 SSC that must be maintained at the level specified in the TSRs to meet the identified safety function. The "Support Systems" column identifies those SSCs, whose failure, would result in the SC-1/2 SSC not being able to perform its identified safety function. The "Functional Requirements" column defines the operability requirements for the identified SC-1/2 SSC. These requirements are necessary for the SC-1/2 SSC to meet its safety function. These functional requirements specifically address the pertinent response parameters related to an accident for which the safety function is being relied upon. Specific acceptance criteria for the SSC to meet the functional requirements, along with surveillance requirements and frequencies, is presented in Appendix A, *Building 991 Complex Technical Safety Requirements*. The "TSR" column provides the linkage from this section to the implementing control specified in Appendix A, *Building 991 Complex Technical Safety Requirements*.

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Table 5-2 Building 991 Complex SC-1/2 SSCs

SC-1/2 SSC	Safety Function	Boundaries	Support Systems	Functional Requirements	TSR
Fire Suppression, Detection, and Alarm System 1. Automatic sprinklers portion 2. Fire extinguishers portion 3. Smoke detectors portion 4. Flow alarms portion	1. The safety function of the automatic sprinklers is to suppress postulated fires occurring in the Building 991 Complex office areas and reduce the likelihood that office area fires will impact waste container storage areas. The system is also credited with mitigating the effects of any fires that may occur in the waste container storage areas. 2. The fire extinguishers prevent a small fire from propagating into a large fire in the waste storage areas. 3. The safety function of the smoke detectors is to provide a system to detect and report fires in non-sprinklered waste storage areas of the Building 991 Complex to facilitate response of the Fire Department. Receipt of the alarm will provide notification to the Fire Department, initiating Fire Department response to extinguish the fire and mitigate any fire related impacts. 4. The safety function of the flow alarms are to provide an alarm to the CAS and FDC to indicate a fire in sprinklered areas of Building 991. Receipt of the alarm will provide notification to the Fire Department, initiating Fire Department response to extinguish the fire and mitigate any fire related impacts.	1. The boundary for the automatic sprinklers are the portions of the wet-pipe and dry-pipe sprinkler systems that provide coverage of the waste storage areas and that provide coverage of the Building 991 office area. This includes the fire water supply and all of the valves, piping, and appurtenances from downstream of the post indicator valve (PIV) to the sprinkler heads and hose connections. The portions of the wet-pipe and dry-pipe sprinkler system that provide coverage of the Building 991 and Building 985 filter plenums are not included as part of the boundary of the automatic sprinkler system. 2. The boundary between the automatic dry-pipe sprinkler systems and the Compressed Air System is from the check valve in the compressed air line to immediately upstream of the air tank (Room 137) associated with the automatic dry-pipe sprinkler systems on the East Dock and on the West Dock (Room 170 and canopy area). 3. Included within the boundary are the smoke detection devices, the fire panels, the flow alarms, and the associated wiring to these devices. Also included is the wiring from the facility to the CAS/FDC.	1. The Domestic Cold Water (DCW) System. Supplies water to the building fire water supply lines. 2. Compressed Air System. Provides air pressure to the dry-pipe sprinkler system lines. 3. *Building Structure.* 4. Electrical Power System. Provides power to fire panels. 5. Plant Fire Department. Provides support once notified that a fire exists.	1. The automatic wet-pipe and dry-pipe sprinkler systems shall be operable. 2. Fire water supplies shall be available at the building. 3. Fire extinguishers shall be available and operable. 4. The alarm transmittal capability of the smoke detectors and the automatic sprinkler system flow alarms to the CAS and FDC shall be operable. 5. The Fire Department shall have the minimum staffing to respond to a fire.	LCO 3.1 AC 5.1 AC 5.7

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Table 5-2 Building 991 Complex SC-1/2 SSCs

SC-1/2 SSC	Safety Function	Boundaries	Support Systems	Functional Requirements	TSR
Heating, Ventilating, and Air Conditioning (HVAC) System (the filtered exhaust portion) 1. Building 991 roof plenum ventilation system and High Efficiency Particulate Air (HEPA) filters. 2. Building 985 plenum HEPA exhaust filters (if ventilation system is intended to be used)	1. The safety function of the HEPA filtration system is to provide HEPA filtration of exhaust ventilation from the complex waste storage areas to reduce the consequences to the MOI and CW. 2. The safety function of the Building 991 exhaust ventilation system is to maintain north and south waste container storage areas, other than Room 166, at a negative pressure relative to atmosphere. NOTE: This system is not required to be operational during power outages or after any NPH or external events.	1. The boundary of the Building 991 filtered exhaust ventilation includes the ductwork that supports the exhaust ventilation system and the exhaust fans required to provide negative differential pressure in the waste storage areas of the Building 991 Complex. Included in the boundary are the electrical lines to the motors and the control interlocks that exist between some of the exhaust fans and supply fans. The differential pressure (dp) gauge that measures the dp in the exhaust ventilation system plenum with respect to atmospheric reference, the dp gauge that measures dp in Room 170 with respect to atmospheric reference, and the dp gauge that measures the dp across the Building 991 roof plenum HEPA filters are included in the boundary. 2. The boundary of the Building 991 Complex filtered exhaust ventilation system also includes the Building 985 stages of HEPA filtration if the system is intended to be used. The ductwork, exhaust fans, and electrical wiring supporting the fans are not included as part of the boundary since operation of the system is not required. Filtration is required if the system serves to exhaust air from the building.	1. Electrical power system. 2. Building structure.	1. Negative dp in the Building 991 exhaust ventilation system plenum with respect to atmospheric reference shall be maintained 2. Negative dp in Room 170 with respect to atmospheric reference shall be maintained when dock doors are closed. 3. Negative dp across the Building 991 exhaust ventilation system filters shall be maintained. 4. The Building 991 and Building 985 (if intended to be used) exhaust ventilation system filtration capability shall be maintained.	LCO 3.2

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Table 5-2 Building 991 Complex SC-1/2 SSCs

SC-1/2 SSC	Safety Function	Boundaries	Support Systems	Functional Requirements	TSR
Building Structure 1. Interior fire barrier. 2. Exterior walls and concrete roofs. 3. Room 153 hallway.	1. The wall between the Building 991 office area and Room 134 is considered a fire rated wall. The fire doors that separate the office area from the storage area are considered part of this fire barrier. This interior fire barrier prevents hot gases from a fire in the office area involving waste containers in the storage area. 2. The safety function of the exterior walls and concrete roofs is to reduce the impact on radioactive waste containers from structural failures caused by NPH/EE. These include design basis high winds, tornadoes, wind driven missiles, atmospheric pressure changes, heavy rain, heavy snow, aircraft crash, and seismic events. 3. The safety function of the hallway floor is to support the waste container storage load for the hallway	1. The interior fire barrier wall includes the portion of the wall that separates the office area from Room 134 of Building 991. This wall extends from approximately Room 122A east to the end of Room 124. The fire doors located in the north-south running hallway that separate the office area from the storage area are included as part of the boundary of the fire barrier. 2. Includes the exterior walls of the building and the concrete roofs of the building. 3. The Room 153 hallway includes those areas of the hallway flooring that serve as a waste container storage area and that is located over the basement of the building.	None.	1. The fire resistant construction of the fire barrier shall be maintained. 2. The doors in the fire barrier shall remain functional at all times. 3. The 12-inch reinforced concrete walls and 4-inch reinforced concrete roofs shall be maintained. 4. The 35 psf design feature of the concrete roofs shall be maintained. 5. The load capacity of the flooring in Room 153 shall be maintained.	Design Feature

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5.2.2 SC-3 SSCs

This section summarizes the safety functions, boundaries, support systems, and functional requirements for those SSCs whose preventive or mitigative function is relied on for regulator-required worker protection from radiological or toxicological hazards. These SSCs are designated SC-3 SSCs. The following SSCs have been identified as SC-3 SSCs:

- Fire Suppression, Detection, and Alarm System (fire phones, fire bells, and the water gong alarms).
- Life Safety/Disaster Warning System.

Table 5-3 provides a matrix of the Building 991 Complex SC-3 SSCs. Column 1 of the table identifies the SSC identified as a SC-3 SSC and the specific attributes of that SSC that make it a SC-3 SSC. The "Safety Function" column of the table provides the reason the SSC was designated as a SC-3 SSC. This column specifically identifies the safety function credited in the safety analysis. Non-safety functions are not provided in this column. If the accident analysis requires that the SSC be relied on to operate after a NPH event, that function will be identified in this column. The "Boundaries" column of the table identifies the specific portions of the SSC that are being relied upon in the accident analysis. This column attempts to be specific in the portions of the SC-3 SSC that must be maintained at the level specified in the TSRs to meet the identified safety function. The "Support Systems" column identifies those SSCs whose failure would result in the SC-3 SSC not being able to perform its identified safety function. The "Functional Requirements" column defines the operability requirements for the identified SC-3 SSC. These requirements are necessary for the SC-3 SSC to meet its safety function. These functional requirements specifically address the pertinent response parameters related to an accident for which the safety function is being relied upon. The acceptance criteria along with the specific surveillance requirements and frequencies for the SSC are provided in Appendix A, *Building 991 Complex Technical Safety Requirements*, as identified in the last column of the table, "TSR". The TSR column provides the linkage from this section to the implementing control specified in Appendix A, *Building 991 Complex Technical Safety Requirements*.

Table 5-3 Building 991 Complex SC-3 SSCs

SC-3 SSCs	Safety Function	Boundaries	Support Systems	Functional Requirements	TSR
Fire Suppression, Detection, and Alarm System (the detection and alarm portions of the system) 1. Smoke detectors 2. Fire phones 3. Water gong alarm 4. Flow alarm 5. LS/DW 6. Local fire alarm	1. Receipt of the alarm from the smoke detectors at the CAS and FDC will initiate communication of the event to personnel in the facility (via the LS/DW). 2. The fire phone use will initiate notification of the event to personnel in the facility (via the local fire alarm). 3. Actuation of the fire suppression system will activate a water gong alarm, notifying personnel in the facility about the event. 4. Receipt of the alarm from the flow alarm at the CAS and FDC will initiate communication of the event to personnel in the facility (via the LS/DW). 5. The LS/DW is used in conjunction with smoke detectors and flow alarms to notify personnel in the facility about the event. 6. Use of a fire phone will activate a local fire alarm, notifying personnel in the facility about the event.	1. Included within the boundary are the smoke detection devices, the audible notification devices (fire bells, water gongs, LS/DW), fire panels, and the associated wiring to these devices. Also included is the wiring from the facility to the CAS/FDC.	1. Automatic sprinkler system. Activation of sprinkler system will activate water flow alarm and water gong. 2. Electrical power system. Provides power to fire panels and LS/DW. 3. DCW system. Provides water to Fire Suppression System. 4. CAS and FDC. Provides notification to facility management for LS/DW announcement. 5. Plant Fire Department: Provides support once notified that a fire exists.	1. The alarm transmittal capability of the fire phones, smoke detectors, and automatic sprinkler system to the CAS and FDC shall be operable. 2. The alarm transmittal capability of the fire phones to the local fire alarms shall be operable. 3. The local fire alarm and water gong capability shall be operable. 4. The LS/DW system shall be audible in all areas of the building or appropriate compensatory actions will be in place.	LCO 3.1, - AC 5.4
Fire Suppression, Detection, and Alarm System 1. Automatic sprinklers portion	1. Provide protection of personnel and equipment in non-waste storage areas of the building.	1. Portions of the wet-pipe and dry-pipe sprinkler systems that provide coverage of the non-waste storage areas. Non-waste storage areas covered by this portion of the automatic sprinkler system include Rooms 130, 137, 138, 156, 157, and 160-165 of Building 991, Building 989, and Building 985.	1. DCW System. Supplies water to the building fire water supply lines. 2. Compressed Air System. Provides air pressure to the dry-pipe sprinkler system lines. 3. Building Structure.	1. The automatic wet-pipe and dry-pipe sprinkler systems shall be operable. 2. Fire water supplies shall be available at the building.	LCO 3.1
Automatic Plenum Deluge System	1. The safety function of the plenum deluge system is to protect the plenum exhaust filters in the event of a fire in Building 991.	1. Included within the boundary are the portions of the wet-pipe and dry-pipe sprinkler system that provide coverage of the Building 991 filter plenum and the Building 985 filter plenum (if the ventilation system is intended to be used). The wiring to the fire panels, the wiring from the facility to the CAS/FDC, and the heat detectors are within the boundary. The manual actuation valves and associated piping are within the boundary.	1. DCW system. Supplies fire water to the building fire water supply lines. 2. Electrical power system. Provides power to the fire panels. 3. Plant Fire Department. Provides support once notified that a fire exists.	1. The automatic deluge systems shall be operable. 2. The plenum overheat detectors shall be operable.	LCO 3.3

5.3 SSC SAFETY CATEGORY DESIGNATION

For DOE-STD-3009 purposes, safety SSCs for the Building 991 Complex are categorized into one of two safety category levels as defined below. The DOE-STD-3009 methodology for classifying safety SSCs does not correlate with the Site methodology for designating the system category of SSCs. Classifications of SSCs as either safety-class or safety-significant satisfies requirements specified in DOE Order 5480.23 (Ref. 5). This section provides the details on those facility SSCs that are necessary for the facility to satisfy evaluation guidelines, provide defense-in-depth, or contribute to worker safety.

- Safety-Class: SSCs whose failure could adversely affect the environment, or safety and health of the MOI as identified by the safety analyses. Adversely effects means that evaluation guidelines are exceeded, therefore safety-class SSCs are SSCs whose preventive or mitigative function is necessary to keep hazardous material exposure to the MOI below the evaluation guidelines. (The evaluation guidelines used for this classification are based on DOE-STD-3011 (Ref. 6) criteria. If the SSC is credited for lowering the risk to the MOI then it is considered a safety-class SSC).
- Safety-Significant: SSCs not designated as safety-class SSCs but whose preventive or mitigative function is a major contributor to defense-in-depth (*i.e.*, prevention of uncontrolled material releases) and/or worker safety as determined from hazard analysis. As a general rule of thumb, safety-significant SSC designations based on worker safety are limited to those SSCs whose failure is estimated to result in an acute worker fatality or serious injuries to workers. Serious injuries refer to medical treatment for immediately life-threatening or permanently disabling injuries from other than standard industrial hazards. Potential latent effects (e.g., potential carcinogenic effects of radiological exposure or uptake) are specifically excluded.

Table 5-4 provides a matrix relating safety features identified in the hazard and accident analyses to safety SSCs, and provides the safety category (safety-class or safety-significant) of the safety SSCs. The safety functions, system boundaries, support systems, and functional requirements for the applicable safety SSC are as described in Section 5.2.1, *SC-1/2 SSCs*, and Section 5.2.2, *SC-3 SSCs*.

Table 5-4 Safety Category Designation of Safety SSCs

Protective Feature	Safety SSC	Accident Scenario Type	SSC Designation	Comments
Interior Fire Barrier (fire rated wall and fire doors separating office area from Room 134)	Building Structure	Facility Fires	Safety Class	Credited with eliminating the potential for a large fire in the office area to impact waste containers in Room 134. Due to the large number of waste containers that could be impacted, the potential exists for the MOI evaluation guidelines to be exceeded if this barrier failed.
Exterior Walls and Concrete Roofs.	Building Structure	NPH/EE Events	Safety Class	Credited with reducing the possibility that an aircraft crash could impact radioactive waste containers. Due to the large number of waste containers that could be impacted, the potential exists for the MOI evaluation guidelines to be exceeded if these barriers were no longer in place.
Hallway Floor Loading Capacity (Room 153)	Building Structure	Spill Scenario 2	Safety Class	The hallway floor capacity is credited in reducing the frequency of an accident that would exceed MOI evaluation guidelines at higher frequencies.
Automatic Sprinklers	The automatic fire suppression portion of the Fire Suppression, Detection, and Alarm Systems	Facility Fires & Facility Fire Scenario 2	Safety Class	Credited with controlling the size of fires possible in the complex and for reducing the likelihood of large fires. Due to the possibility of a fire in the facility larger than currently analyzed that impacts significant numbers of waste containers, the potential exists for the MOI evaluation guidelines to be exceeded if this feature failed.

Table 5-4 Safety Category Designation of Safety SSCs

Protective Feature	Safety SSC	Accident Scenario Type	SSC Designation	Comments
Flow Alarm / Fire Department Response	The fire detection and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenarios 2, 4	Safety Significant	The safety function of the flow alarms is to notify the Fire Department of a fire in Building 991 waste storage areas (other than Building 996 and Corridor B). The flow alarms are specifically credited in the mitigation of fires larger than those evaluated in NSTR-011-98. However, the functioning of the flow alarms would not reduce MOI consequences from a very large fire to a level below evaluation guidelines.
Smoke Detectors / Fire Department Response	The fire detection and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenario 2	Safety Significant	The safety function of the smoke detectors is to notify the Fire Department of a fire in Building 996 or Corridor B. The smoke detectors are specifically credited to mitigate fires larger than those evaluated in NSTR-011-98. However, the functioning of the smoke detectors would not reduce MOI consequences from a very large fire to a level below evaluation guidelines.
Fire Extinguishers	The fire extinguishers located throughout the facility	Facility Fire Scenarios 1, 2, 3, 4	Safety Significant	The fire extinguishers are credited with preventing a small fire from propagating into a larger fire. However, the loss of this feature does not change scenario frequencies sufficiently to cause MOI evaluation guidelines to be exceeded.
Fire Phones / Fire Department Response	The fire detection and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenarios 1, 2, 3, 4	Safety Significant	The fire phones are not specifically credited in the safety analyses but provide a defense-in-depth safety function to notify the Fire Department of a fire in the Building 991 Complex.

Table 5-4 Safety Category Designation of Safety SSCs

Protective Feature	**Safety SSC**	**Accident Scenario Type**	**SSC Designation**	**Comments**
Fire Phones / Local Fire Alarm	The fire alarm portion of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenarios 1, 2, 3, 4 & Facility Explosion Scenario 1	Safety Significant	The fire phones are not specifically credited in the safety analyses but provide a defense-in-depth worker safety function to initiate a fire alarm, notifying personnel inside Building 991 of a fire or other type of incident.
Water Gong Alarm / Automatic Sprinklers	The automatic fire suppression and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems	Facility Fire Scenarios 1, 2, 3 & Facility Explosion Scenario 1	Safety Significant	The water gong alarms are not specifically credited in the safety analyses but provide a defense-in-depth worker safety function by indicating automatic sprinkler system activation, notifying personnel outside of Building 991 of a fire or other type of incident.
Water Gong Alarm	The fire alarm portion of the Fire Suppression, Detection, and Alarm Systems	Spill Scenario 2	Safety Significant	The water gong alarms are not specifically credited in the safety analyses but provide a defense-in-depth worker safety function by indicating flow in the automatic sprinkler system following floor collapse, notifying personnel outside of Building 991 of an incident.
Automatic Plenum Deluge	The automatic fire suppression portion of the Fire Suppression, Detection, and Alarm Systems	Dominant Facility Fire Scenario 2	Safety Significant	The automatic plenum deluge systems are not specifically credited in the safety analyses but provide a defense-in-depth safety function for the protection of the filters in the exhaust ventilation systems.

Table 5-4 Safety Category Designation of Safety SSCs

Protective Feature	Safety SSC	Accident Scenario Type	SSC Designation	Comments
Flow Alarm / LS/DW	The fire alarm portion of the Fire Suppression, Detection, and Alarm Systems and the vocal announcement portion of the LS/DW System	Spill Scenario 2	Safety Significant	The receipt of flow alarms at the CAS and FDC and the subsequent LS/DW announcements notifying personnel inside Building 991 of an incident are not specifically credited in the safety analyses but provide a defense-in-depth worker safety function.
Smoke Detectors / LS/DW	The fire detection and fire alarm portions of the Fire Suppression, Detection, and Alarm Systems and the vocal announcement portion of the LS/DW System	Facility Fire Scenario 1	Safety Significant	The receipt of smoke alarms at the CAS and FDC and the subsequent LS/DW announcements notifying personnel inside Building 991 of an incident are not specifically credited in the safety analyses but provide a defense-in-depth worker safety function.
LS/DW	The vocal announcement portion of the LS/DW System	Facility Fire Scenario 3 & Spills Scenarios 1, 2 & Puncture Scenario 1 & Container Explosion Scenario 1 & Facility Explosion Scenario 1	Safety Significant	The use of LS/DW announcements as part of emergency response is not specifically credited in the safety analyses but can provide notification to building occupants in the event of fire, airborne contamination, and Site or building emergency response activities and serve as a defense-in-depth worker safety function.

Table 5-4 Safety Category Designation of Safety SSCs

Protective Feature	Safety SSC	Accident Scenario Type	SSC Designation	Comments
Building 991 Filtered Exhaust	The filtered exhaust ventilation portion of the Building 991 HVAC System.	Facility Fire Scenario 1	Safety Class	The Building 991 filtered exhaust ventilation system is credited in reducing the consequences of a small fire to a level below MOI evaluation guidelines. The system also lowers consequences to the MOI for internal event accident scenarios that do not result in MOI consequences exceeding evaluation guidelines when the system is not credited.
Building 985 Filtered Exhaust (if the ventilation system is intended to be used)	The filtered exhaust ventilation portion of the Building 985 HVAC System.	Facility Fire Scenario 1	Safety Class	The Building 985 filtered exhaust ventilation system is credited in reducing the consequences of a small fire to a level below MOI evaluation guidelines. The system also lowers consequences to the MOI for internal event accident scenarios that do not result in MOI consequences exceeding evaluation guidelines when the system is not credited.

5.4 REFERENCES

1 *Safety Analysis for the Building 991 Complex Final Safety Analysis Report*, **NSTR-011-98**, Nuclear Safety Technical Report, Rocky Mountain Remediation Services, L.L.C., Revision 1, January 1999.

2 *Preparation Guide for U. S. Department of Energy Non-reactor Nuclear Facility Safety Analysis Reports*, **DOE-STD-3009-94**, U. S. Department of Energy, Washington, DC, July, 1994.

3 *Design Process Requirements*, **1-V51-COEM-DES-210**, Revision 3, Rocky Flats Environmental Technology Site, Golden, CO, June 1, 1998.

4 *General Design Criteria*, **DOE Order 6480.1A**, U. S. Department of Energy, Washington, DC, April 1989.

5 *Nuclear Safety Analysis Reports*, **DOE Order 5480.23**, U. S. Department of Energy, Washington, DC, April 30, 1992.

6 *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*, **DOE-STD-3011-94**, U. S. Department of Energy, Washington, DC, November, 1994.

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APPENDIX A

BUILDING 991 COMPLEX
TECHNICAL SAFETY REQUIREMENTS

APPENDIX A
BUILDING 991 COMPLEX TECHNICAL SAFETY REQUIREMENTS

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1. USE AND APPLICATION

The TECHNICAL SAFETY REQUIREMENTS (TSRs) for the BUILDING 991 COMPLEX establish those requirements that define the conditions, safe boundaries, and ADMINISTRATIVE CONTROLS necessary to ensure safe operation of the facility and reduce the risk to immediate workers, collocated workers, the public, and the environment from uncontrolled releases of hazardous materials. There are four types of controls used to provide this assurance: LIMITING CONDITIONS FOR OPERATION (LCOs), SURVEILLANCE REQUIREMENTS (SRs), ADMINISTRATIVE CONTROLS (ACs), and DESIGN FEATURES. A separate "Use and Application" section proceeds each of the LCO and AC sections providing information and instructions for using and applying each type of control. Compliance with all TSRs as written is mandatory.

BASES for each of the TSR controls immediately follow the stated controls rather than being included as an annex to the TSRs. This facilitates a better understanding of the need for the control and avoids forcing the reader to search the document for such information.

1.1 DEFINITIONS

NOTE
The defined terms of this section appear in capitalized type throughout the TSRs.

TERM	DEFINITION
ADMINISTRATIVE CONTROLS (ACs)	Provisions relating to organization and management, conduct of operations, procedures, record-keeping, assessment, and reporting necessary to ensure the safe operation of a facility.
ADMINISTRATIVE OPERATING LIMITS (AOLs)	Specific administrative controls/limits that have been credited in the Final Safety Analysis Report (FSAR) Safety Analysis. AOLs are credited as providing a reduction in postulated accident scenario initiation frequency and/or a reduction in postulated accident scenario consequences. Such controls are more precise and discrete than those defined by a safety management program (SMP) or the program elements of a SMP. The AOLs are an administrative equivalent to hardware requirements specified in LCOs and, as such, have requirements for verification of the AOL and requirements for actions following DISCOVERY of a noncompliance with the AOL.

TERM	DEFINITION
AFFECTED AREA	That portion of the BUILDING 991 COMPLEX in which the credited safety function provided by a single system, subsystem, train, component or device is compromised by an OUT-OF-TOLERANCE or other CONDITION for which REQUIRED ACTIONS are specified.
BASIS/BASES	Summary statement(s) of the rationale for the LCOs and associated SRs and ACs. The BASES explain how the numeric value, the specified function, or the surveillance fulfills the credited safety function assumed in the FSAR Safety Analysis.
BUILDING 991 COMPLEX	The set of facilities supporting the mission of Building 991 to store transuranic (TRU) waste containers and to stage Special Nuclear Material (SNM) in preparation for off-site shipment. This includes Building 991, Building 996, Building 997, Building 998, Building 999, Building 984, Building 985, Building 989, and Building 992.
COMPLETION TIME	The amount of time allowed to complete a REQUIRED ACTION. The COMPLETION TIME starts whenever a situation (*e.g.*, not OPERABLE equipment or variable not within limits) is DISCOVERED that requires entering the REQUIRED ACTION for a given CONDITION. REQUIRED ACTIONS shall be performed before the specified COMPLETION TIME expires, except as specified under SUSPEND OPERATIONS.
CONDITION	Configuration and status of the facility related to compliance with the TSRs for which REQUIRED ACTIONS are performed within specified COMPLETION TIMES, including; 1. Discrete degradations of LCO-related SAFETY SSCs; and 2. Noncompliance with ACs.
CREDITED PROGRAMMATIC ELEMENT	A functional (performance language) statement depicting analytical assumptions embodied in safety analysis specific to a given program. These functional statements relate to assumptions that determine the progression of accident scenarios.
DEFENSE-IN-DEPTH	Engineered features and/or administrative programs or program elements which are not used in analysis to reduce frequency or consequences but add additional levels of safe operations. Margin of safety is established by the bounds of the analysis and is not impacted by the loss of, or deficiencies in, DEFENSE-IN-DEPTH items.

TERM	DEFINITION
DESIGN FEATURES	Those passive features which, if altered or modified, could have a significant effect on safety.
DISCOVERY/ DISCOVERED	The point in time when it is realized that a CONDITION has been entered.
EMERGENCY EVACUATION	Any evacuation as a result of a significant deviation from planned or expected behavior or course of events that could result in significant consequences to people, property, the environment, or security. It includes unusual events, alerts, Site emergencies, and general emergencies.
LIMITING CONDITION FOR OPERATION (LCO)	The lowest functional capability or performance level of SAFETY SSCs and their support systems required for safe operations of the facility.
NUCLEAR MATERIAL	Includes Special Nuclear Material (enriched uranium, uranium-233, uranium-235, or plutonium), americium, or neptunium in quantities of one gram or more. It does not include natural uranium, depleted uranium, contamination, or sealed sources.
OPERABLE/ OPERABILITY	A SAFETY SSC shall be OPERABLE when it is capable of performing its safety function(s) as specified in Chapter 5 of the FSAR for compliance with the TSRs.
OUT OF COMMISSION	Identifies equipment that has been rendered not available or credited for operation. OUT OF COMMISSION equipment is considered to be administratively removed from the facility and no longer subject to the requirements specified in the TSRs. OUT OF COMMISSION implies that actual physical modification, isolation, or removal can be performed without affecting the overall safety of the facility. For the purpose of the TSRs, equipment, systems, and/or areas are OUT OF COMMISSION when all of the following conditions have been satisfied: a. The isolation boundary and the affected equipment is properly tagged or labeled and controlled in a manner that will prevent use. b. An evaluation of the administrative removal of the affected equipment from service on facility safety has been performed. c. Analysis shows that any radioactive or other hazardous material remaining in the OUT OF COMMISSION equipment is safely contained.

TERM	DEFINITION
OUT-OF-SERVICE	Equipment formally designated as not available to perform its intended safety function.
OUT-OF-TOLERANCE	A CONDITION that exists upon failure to meet LCOs or SRs when the REQUIRED ACTIONS have been completed within the specified COMPLETION TIMES.
REQUIRED ACTIONS	The mandatory response when an LCO or AC cannot be met. REQUIRED ACTIONS include the COMPLETION TIMES for facility operation in an OUT-OF-TOLERANCE or an AC noncompliance before it is required to change operating configuration, except as specified under SUSPEND OPERATIONS.
SAFETY-CLASS STRUCTURES, SYSTEMS, AND COMPONENTS (SAFETY-CLASS SSCs)	Those SAFETY SSCs that have been credited in the FSAR Safety Analysis to provide protection of the environment or provide protection for the health and safety of the public (as defined by the maximum exposed off-site individual).
SAFETY-SIGNIFICANT STRUCTURES, SYSTEMS, AND COMPONENTS (SAFETY-SIGNIFICANT SSCs)	Those SAFETY SSCs that have been credited in the FSAR Safety Analysis to provide protection for the health and safety of the immediate worker or to provide DEFENSE-IN-DEPTH protection for the health and safety of the immediate worker, the collocated worker (as defined by a 100 meter distant receptor), or the public (as defined by the maximum exposed off-site individual).
SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS (SAFETY SSCs)	Those structures, systems, and components (SSCs) that are important to safety (*i.e.*, those SSCs that have been credited in the FSAR Safety Analysis). SAFETY SSCs consist of SAFETY-CLASS and SAFETY-SIGNIFICANT SSCs.
SURVEILLANCE REQUIREMENTS (SRs)	Requirements relating to testing, calibration, or inspection of SAFETY SSCs to ensure that the OPERABILITY of the LCO-related SAFETY SSC is maintained and/or that operations are within the specified parameters of the LCO.

TERM	DEFINITION
SUSPEND OPERATIONS	A formal termination of all activities except for those directly involved in: 1. Placing and maintaining the BUILDING 991 COMPLEX in a safe configuration; 2. Restoring the safety function associated with the suspension; 3. Restoring the safety function associated with other LCO OUT-OF-TOLERANCES; or 4. Remediating AC noncompliance CONDITIONS. LCO 3.0.11 addresses responses to a SUSPEND OPERATIONS REQUIRED ACTION.
TECHNICAL SAFETY REQUIREMENTS (TSRs)	TSRs define the LCOs, SRs, ACs, Design Features and BASES thereof necessary to protect the health and safety of the public and to reduce the potential risk to workers from the uncontrolled release of radioactive or other hazardous materials and from radiation exposure due to inadvertent criticality.
VIOLATION	A VIOLATION of a TSR can occur as a result of any of the following circumstances: 1. Failure to take REQUIRED ACTIONS within the specified COMPLETION TIME following: 1) Failure to meet an LCO, OR 2) Failure to successfully meet an LCO SR; 2. Failure to perform an LCO SR within the specified frequency; or 3. 3. Failure to perform the REQUIRED ACTIONS associated with an AC that is not being met within specified COMPLETION TIMES.

1.2 ACRONYMS

AC	ADMINISTRATIVE CONTROL
AOL	ADMINISTRATIVE OPERATING LIMIT
CSE	Criticality Safety Evaluation
DOE	Department of Energy
DOT	Department of Transportation
FEVS	Filtered Exhaust Ventilation System
FHA	Fire Hazards Analysis
FSAR	Final Safety Analysis Report
HEPA	High Efficiency Particulate Air (filters)
IDC	Item Description Code
JCO	Justification for Continued Operation
LCO	LIMITING CONDITION FOR OPERATION
LLW	Low-Level Waste
MAR	Material-at-Risk
NFPA	National Fire Protection Association
POC	Pipe Overpack Container
POD	Plan of the Day
RFFO	Rocky Flats Field Office
SC	System Category
Site	Rocky Flats Environmental Technology Site
SMP	Safety Management Program
SNM	Special Nuclear Material
SR	SURVEILLANCE REQUIREMENT
SSC	Structure, System, and Component
TRU	Transuranic (waste)
TSR	TECHNICAL SAFETY REQUIREMENTS
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WG Pu	Weapons Grade Plutonium

1.3 SAFETY LIMITS/LIMITING CONTROL SETTINGS

There are no Safety Limits or Limiting Control Settings for the BUILDING 991 COMPLEX.

1.4 LIMITING CONDITIONS FOR OPERATIONS/SURVEILLANCE REQUIREMENTS

LIMITING CONDITIONS FOR OPERATION (LCOs), presented in Section 3, are imposed on SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS (SSCs) credited in the FSAR Safety Analysis to reduce the frequency or to mitigate the consequences of postulated accidents impacting the public and/or the collocated worker. The BUILDING 991 COMPLEX LCO addresses the following systems:

- BUILDING 991 COMPLEX Automatic Sprinkler Systems and Flow/Smoke Detection Alarms.
- BUILDING 991 COMPLEX Filtered Exhaust Ventilation Systems.
- BUILDING 991 COMPLEX Automatic Plenum Deluge Systems.

SURVEILLANCE REQUIREMENTS (SRs), presented in Section 4, are requirements relating to testing, calibration, or inspection of SAFETY SSCs to ensure that the OPERABILITY of the LCO-related SAFETY SSCs and their support systems is maintained and/or that operations are within the specified parameters of LCOs. This section of the TSRs contains the requirements necessary to maintain operation of the BUILDING 991 COMPLEX within the LCOs. In the event that SRs are not successfully completed or accomplished within their specified frequency, the SAFETY SSCs involved are assumed to be not OPERABLE and REQUIRED ACTIONS defined by the LCOs are taken until the SAFETY SSCs can be shown to be OPERABLE.

1.5 ADMINISTRATIVE CONTROLS

ADMINISTRATIVE CONTROLS (ACs), presented in Section 5, are provisions relating to organization and management, conduct of operations, procedures, record-keeping, assessment, and reporting necessary to ensure safe operation of the facility. The ACs for the BUILDING 991 COMPLEX are defined by CREDITED PROGRAMMATIC ELEMENTS and by specific controls/limits identified as ADMINISTRATIVE OPERATING LIMITS (AOLs).

AOLs are specific administrative controls/limits that have been credited in the FSAR Safety Analysis as providing a reduction in postulated accident scenario initiation frequency and/or a reduction in postulated accident consequences. Such controls are more precise and discrete than those defined by a SMP or the program attributes of a SMP. The AOLs are an administrative equivalent to hardware requirements specified in LCOs and, as such, have requirements for surveillance of the AOL and requirements for actions following DISCOVERY of a noncompliance with the AOL. Examples of AOLs include: waste container specifications,

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limits on container radioactive material, and restriction of selected items (*e.g.*, combustibles, flammable gases).

1.6 DESIGN FEATURES

DESIGN FEATURES are the facility passive protective features that reduce the frequency and/or mitigate the consequences of uncontrolled releases of radioactive or other hazardous materials from the facility for postulated accident scenarios analyzed in the FSAR. These DESIGN FEATURE descriptions are provided in the TSRs to assure that evaluations of proposed changes or modifications to these DESIGN FEATURES are properly performed and documented, consistent with requirements specified in the TSRs.

1.7 FREQUENCY NOTATION

The frequency notations, as used in surveillances and elsewhere, are defined as follows when included in the TSR:

Notation	Minimum Frequency (Periodicity Notation)
Once per Working Shift	At least once per Working Shift.
Once per Day	At least once per 24 hours.
Once per Week	At least once per 7 days.
Once per Month	At least once per 31 days.
Once per Quarter	At least once per 92 days.
Once per 6 Months	At least once per 6 months.
Once per Year	At least once per 12 months.
Once per 18 Months	At least once per 18 months.
Once per 3 Years	At least once per 36 months

1.8 TECHNICAL SAFETY REQUIREMENTS BASES CONTROL

The contractor may make changes to the TSR BASES without prior Department of Energy-Rocky Flats Field Office (DOE-RFFO) approval provided the changes do not involve any of the following:

1. A change in the controls specified in the TSRs; or
2. A change to the FSAR that involves a positive USQ.

Proposed changes that meet the criteria of (1) or (2) above shall be reviewed and approved by the DOE-RFFO prior to implementation. Changes to the BASES that may be

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implemented without prior DOE-RFFO approval will be provided to the DOE-RFFO during annual updates to this FSAR.

1.9 LOGICAL CONNECTORS

Logic terms (**AND**, **OR**) may be used in the CONDITIONS, REQUIRED ACTIONS, or the COMPLETION TIME section of an LCO REQUIRED ACTION or AC REQUIRED ACTION statement or in the SURVEILLANCE REQUIREMENTS or frequency sections of the LCO SURVEILLANCE statement. The following definitions and format are applicable to the use of logic terms throughout the TSRs.

NOTE: The defined terms of this section appear in CAPITALIZED, bolded, and underlined type throughout the TSRs.

Definitions of Logic Terms

Term	Definition
AND	Used to connect two or more sets of criteria that must both (all) be satisfied for a given logical decision.
OR	Used to denote alternate combinations or criteria, meaning either one or the other criterion will satisfy a given logical decision.

The formats for the level of logic are illustrated in the following examples:

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. The CONDITION	For **statements containing a single level** – The connector is *left justified to the column* and the criteria are *single* numbered. 1 The REQUIRED ACTION **OR** 2 The REQUIRED ACTION	

This example demonstrates that for CONDITION 1, either REQUIRED ACTION 1 or REQUIRED ACTION 2 must be completed. This is because the logical connector **OR** is used

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1.2 LOGICAL CONNECTORS (continued)

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
	For **statements containing two levels:** For the 1st level – The connector is *left justified to the column* and the criteria are *single* numbered. For the 2nd level – The connector is *indented once to the right* and the criteria are *double numbered.*	
1. The CONDITION	1 The REQUIRED ACTION **OR** 2.1 The REQUIRED ACTION **AND** 2.2 The REQUIRED ACTION	

This example demonstrates that for CONDITION 1, either REQUIRED ACTION 1 or REQUIRED ACTION 2 must be completed. If REQUIRED ACTION 2.1 is chosen, an additional requirement, indicated by the indented logical connector **AND**, is imposed. This additional requirement is met by performing REQUIRED ACTION 2.2.

1.2 LOGICAL CONNECTORS (continued)

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
	For **statements containing three levels:** For the 1st level – The connector is *left justified to the column* and the criteria are *single* numbered. For the 2nd level – The connector is *indented once to the right* and the criteria are *double numbered.* For the 3rd level – The connector is *indented twice to the right* and the criteria are *triple numbered.*	
1. The CONDITION	1 The REQUIRED ACTION **OR** 2.1 The REQUIRED ACTION **AND** 2.2.1 The REQUIRED ACTION **OR** 2.2.2 The REQUIRED ACTION	

This example demonstrates that for CONDITION 1, either REQUIRED ACTION 1, or REQUIRED ACTION 2.1 must be completed. If 2.1 is chosen, an additional requirement, indicated by the indented logical connector **AND**, is imposed. This additional requirement is met by choosing 2.2.1 or 2.2.2. The indented position of the logical connector **OR** indicates that 2.2.1 and 2.2.2 are alternate and equal choices, one of which shall be performed.

2. SAFETY LIMITS AND LIMITING CONTROL SETTINGS

There are no Safety Limits or Limiting Control Settings for the BUILDING 991 COMPLEX.

3./4. LIMITING CONDITIONS FOR OPERATION/SURVEILLANCE REQUIREMENTS

A LIMITING CONDITION FOR OPERATION (LCO) and associated SURVEILLANCE REQUIREMENTS (SRs) have been identified for the BUILDING 991 COMPLEX Automatic Sprinkler Systems and Flow Alarms. These systems are credited in the FSAR Safety Analysis to reduce the frequency of large fires in the facility that have the potential to impact waste container storage areas. As a result, the system indirectly reduces the consequences of analyzed accidents impacting the collocated workers and the public.

3.0/4.0 USE AND APPLICATION

LCO 3.0.1 through LCO 3.0.11 and SR 4.0.1 through SR 4.0.4 establish the general requirements applicable to LCO 3.1, BUILDING 991 COMPLEX Automatic Sprinkler Systems and Flow Alarms, at all times. A summary table of the general requirements or topics is presented below and is followed by a more detailed discussion of each general requirement and their BASES.

Table 1 SUMMARY OF LCO/SR GENERAL REQUIREMENTS

LCO/SR	GENERAL REQUIREMENT / TOPIC	REMARKS
LCO 3.0.1	LCOs Shall Be Met	LCO Applicability Statements define when LCOs must be met. Refer to LCO 3.0.2 when LCOs cannot be met.
LCO 3.0.2	LCO REQUIRED ACTIONS Shall Be Met	REQUIRED ACTIONS must be completed for specified CONDITIONS. If LCO CONDITION is remedied before REQUIRED ACTION COMPLETION TIME, REQUIRED ACTION does not have to be performed. Refer to LCO 3.0.3 when REQUIRED ACTION is not defined or cannot be met.
LCO 3.0.3	LCO REQUIRED ACTION Cannot Be Met Or Is Not Provided	When an LCO REQUIRED ACTION cannot be met or is not defined, the facility must SUSPEND OPERATIONS in the AFFECTED AREA within 4 hours.
LCO 3.0.4	Return To Service	OPERABILITY tests of SAFETY SSCs or other equipment may be performed under administrative control without meeting applicable LCO REQUIRED ACTIONS. This is an exception to LCO 3.0.2.
LCO 3.0.5	Response to an LCO VIOLATION	LCO VIOLATIONS must be reported, corrective actions taken, and, if the LCO CONDITION still exists, operations must be suspended.
LCO 3.0.6	Calibration	Devices used to demonstrate compliance with LCOs must be calibrated. Entering LCO REQUIRED ACTIONS may be delayed for the lesser of 24 hours or the next SR inspection for installed devices found to be past due for calibration between SR inspections under certain conditions.

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Table 1 SUMMARY OF LCO/SR GENERAL REQUIREMENTS

LCO/SR	GENERAL REQUIREMENT / TOPIC	REMARKS
LCO 3.0.7	Performing SURVEILLANCE REQUIREMENTS	If an SR inspection or test would result in temporarily entering an LCO CONDITION, the applicable REQUIRED ACTIONS may not have to be entered. This is an exception to LCO 3.0.2.
LCO 3.0.8	Planned OUT-OF-TOLERANCES	If an activity would result in entering an LCO CONDITION, the applicable REQUIRED ACTIONS must be entered before performing the activity. This also applies to significant risk SR inspections or tests covered by LCO 3.0.6.
LCO 3.0.9	Response To An EMERGENCY EVACUATION	LCO specified times for SRs or REQUIRED ACTIONS can be extended for the duration of an EMERGENCY EVACUATION from a facility. This is an exception to LCO 3.0.2 and SR 4.0.1.
LCO 3.0.10	Initiation Of REQUIRED ACTIONS	REQUIRED ACTION(S) shall be initiated when a CONDITION is DISCOVERED and shall be completed within the allowable COMPLETION TIME(S).
LCO 3.0.11	Suspending Operations	Any activity that can be placed in a safe configuration shall be terminated within the REQUIRED ACTION COMPLETION TIME.
SR 4.0.1	SRs Shall Be Met	LCO Applicability Statements or SRs define when SRs must be met. LCO REQUIRED ACTIONS must be entered upon failure to meet an SR. LCO-related SAFETY SSCs must meet applicable SRs before being declared OPERABLE.
SR 4.0.2	Frequencies	SRs define inspection/test frequencies that must be met. Refer to SR 4.0.3 when SR frequencies are not met.
SR 4.0.3	Surveillance is not performed within the specified frequency	Failure to perform an SR within the specified frequency shall constitute a failure to meet OPERABILITY requirements for an LCO and results in a TSR/SR VIOLATION.

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LCO 3.0.1 LCOs Shall Be Met

LCOs shall be met during the specified operating configurations and in the specified areas/locations in the Applicability Statements, except as provided in LCO 3.0.2.

LCO 3.0.2 LCO REQUIRED ACTION Shall Be Met

Upon DISCOVERY of a failure to meet an LCO, the associated REQUIRED ACTION(S) shall be met. If the LCO is restored before expiration of the specified COMPLETION TIME(S), completion of the REQUIRED ACTION(S) is not required, unless otherwise stated.

LCO 3.0.3 LCO REQUIRED ACTION Cannot Be Met Or Is Not Provided

When an LCO is not met, and the associated REQUIRED ACTION (S) cannot be met or are not provided, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four (4) hours. Actions taken to SUSPEND OPERATIONS shall be initiated upon the determination that the specified REQUIRED ACTION(S) cannot be met.

LCO 3.0.4 Return To Service

Equipment removed from service or declared not OPERABLE may be returned to service to perform testing required to demonstrate its OPERABILITY. This is an exception to LCO 3.0.2 for the system returned to service to perform the testing required to demonstrate OPERABILITY.

LCO 3.0.5 Response To An LCO VIOLATION

Upon DISCOVERY of a VIOLATION, the following ACTIONS are required:

1) SUSPEND OPERATIONS in AFFECTED AREAS.

2) Notify the DOE-RFFO in accordance with approved procedures.

3) Prepare an occurrence report in accordance with the approved procedures.

4) Prepare and implement a recovery plan describing the steps leading to compliance.

LCO 3.0.6 Calibration

Measurement devices used to demonstrate compliance with LCOs shall be calibrated to plant design, manufacturer's specification and/or industry standards as determined by engineering.

LCO 3.0.6 (cont.)

Calibration that requires removal of equipment from service does not constitute failure to meet an LCO if individual calibration procedures describe appropriate limitation beyond which an OUT-OF-TOLERANCE CONDITION would exist. If such limitations are not described in the individual calibration procedures, a planned OUT-OF-TOLERANCE shall be declared before removing equipment from service for calibration.

If an installed indicator is reading as expected and within required parameters, but is found to be past due for calibration during the interval between required SURVEILLANCES, and redundant indication is not available, declaring the applicable LCO not met may be delayed for up to 24 hours, or the interval of the SURVEILLANCE, whichever is shorter, from the time it is DISCOVERED that the indicator is past due for calibration. This delay period is permitted to allow the installation of a calibrated substitute or to calibrate the installed indicator, which allows validation of the actual operating parameter. The failure of a calibration requires that the affected SAFETY SSC be declared OUT-OF-TOLERANCE, and the LCO REQUIRED ACTIONS taken, as the minimum requirements described for the associated LCO that cannot be met. Reporting of the failed calibration is required in accordance with contractor procedures.

If the in-calibration indicator reading is not taken within the delay period, the LCO shall not met, and the COMPLETION TIMES of the REQUIRED ACTIONS for the applicable LCO CONDITIONS shall begin immediately upon expiration of the delay period. If the in-calibration indicator reading is outside required parameters within the delay period, the LCO shall not be met and the applicable REQUIRED ACTIONS shall be entered. The COMPLETION TIMES of the REQUIRED ACTIONS begin immediately upon observing the unsatisfactory reading with an in-calibration indicator.

LCO 3.0.7 **Performing SURVEILLANCE REQUIREMENTS**

An SR inspection or test that requires removal of equipment from service or that causes an LCO specification to be exceeded does not constitute failure to meet an LCO provided that individual work control documents implementing these inspections or tests describe appropriate limitations beyond which an OUT-OF-TOLERANCE CONDITION would exist.

Failing an LCO-required SR requires the system component to be deemed not OPERABLE and the appropriate REQUIRED ACTIONS be taken.

If it is determined that LCO-required equipment is not OPERABLE during the performance of an inspection or test, the appropriate REQUIRED ACTIONS shall be taken.

LCO 3.0.7 BASIS

LCO 3.0.7 allows the testing of LCO-related SAFETY SSCs and supporting equipment under administrative or procedural controls without declaring that LCO requirements are not met and entering the REQUIRED ACTIONS of an LCO. The sole purpose of LCO 3.0.7 is to provide an exception to LCO 3.0.2 to allow the performance of SR inspections/tests that require removing equipment from service or temporarily failing to meet LCO requirements as part of the required inspection or testing. This exception is not intended to place the facility at risk as an operational convenience. The removal of LCO-related SAFETY SSCs or supporting equipment from service and the inspection or testing of SAFETY SSCs or supporting equipment that results in not meeting LCO requirements, without first entering the REQUIRED ACTIONS of the LCO as a planned OUT-OF-TOLERANCE, should be evaluated to determine the level of risk associated with the performance of the SR inspection or test. If the impact of the SR inspection/test on facility risk is significant (as determined by facility management), the inspection/testing associated with the SR should be performed as a planned OUT-OF-TOLERANCE under LCO 3.0.8. If the impact of the SR inspection/test on facility risk is low, the inspection/testing associated with the SR may be performed without entering the LCO REQUIRED ACTIONS corresponding to the loss of the equipment.

Administrative or procedural controls must ensure that the time associated with removing the equipment from service to perform the inspection/test, which may conflict with the requirements of LCO REQUIRED ACTIONS, is limited to the time absolutely necessary to perform the SR inspection or test. Also, the administrative or procedural controls must restrict the activity to performance of only the SR inspection/test. LCO 3.0.7 is not to be used to perform any inspections or testing outside of the activities directly associated with performing the SR inspection or test. Individual SR procedures are required to provide appropriate limitations to ensure that the safety of the facility is maintained while testing any attributes of LCO-related SAFETY SSCs.

The failure of an SR requires that the affected SAFETY SSC is deemed not OPERABLE, that an LCO CONDITION is declared, and that the corresponding LCO REQUIRED ACTIONS are taken. Failure of an SR indicates that the minimum requirements to demonstrate compliance with the LCO are not being met. Reporting of the failed SR is required in accordance with Occurrence Reporting requirements.

LCO 3.0.8 Planned OUT-OF-TOLERANCES

If the performance of a planned activity will result in noncompliance with the requirements of an LCO, then the applicable LCO REQUIRED ACTION(S) shall be implemented prior to performing the activity. Prior to entering this planned OUT-OF-TOLERANCE CONDITION, the DOE-RFFO shall be notified in accordance with approved procedures.

Planned OUT-OF-TOLERANCES do not require post-activity reporting.

LCO 3.0.9 Response To An EMERGENCY EVACUATION

Failure to initiate or complete an SR or a REQUIRED ACTION resulting from an OUT-OF-TOLERANCE CONDITION due to an EMERGENCY EVACUATION within the BUILDING 991 COMPLEX does not constitute a VIOLATION of the TSR. However, upon authorized resumption of normal operations, the SR or REQUIRED ACTION must be initiated and completed as soon as practicable.

LCO 3.0.10 Initiation of REQUIRED ACTIONS

REQUIRED ACTION(S) shall be initiated when a CONDITION is DISCOVERED and completed as soon as practicable within the allowed COMPLETION TIME. COMPLETION TIMES shall not be used for operational convenience.

LCO 3.0.11 Suspending OPERATIONS

Any activity that can be placed in a safe configuration within the REQUIRED ACTION COMPLETION TIME shall be terminated. Activities that require more time than specified for the REQUIRED ACTION to be placed in a safe configuration will have had a termination sequence formally initiated as soon as practicable. In any case, each activity underway at the time of suspension of operations should be terminated as soon as a safe configuration has been reached, and no additional time should be used for operational convenience.

Facility management shall determine activities to be continued for the purpose of maintaining a safe facility configuration, weighing worker and public safety risk that may arise from the suspension or other OUT-OF-TOLERANCE.

SR 4.0.1 SRs Shall Be Met

SRs shall be met during the specified operating conditions in the Applicability Statements for individual LCOs unless otherwise stated in the SR.

SR 4.0.2 Frequencies

Each SR inspection or test shall be performed within 1.25 of the specified frequency. Use of the 25% grace period does not extend the due date for the next SURVEILLANCE period.

SR 4.0.3 SURVEILLANCE is not performed within the specified frequency

Failure to perform an SR within the specified frequency (TSR VIOLATION) shall constitute a failure to meet OPERABILITY requirements for an LCO. Exceptions are stated in the individual SRs and LCO 3.0.9. Surveillances do not have to be performed on equipment that is not OPERABLE or when the equipment has been designated OUT-OF-SERVICE.

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3./4. LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3.1 LIMITING CONDITION FOR OPERATION: BUILDING 991 COMPLEX AUTOMATIC SPRINKLER SYSTEMS AND FLOW/SMOKE DETECTION ALARMS

LCO: **The BUILDING 991 COMPLEX Automatic Sprinkler System and Flow/Smoke Detection Alarm Transmittal Systems Shall Be OPERABLE.**

APPLICABILITY: At all times in the Building 991 Waste Container Storage Areas, in the Building 991 Office Areas, in Building 998 (Room 300 and Corridor A), in the Building 991 West Dock Canopy Area, in the Building 991 East Dock Canopy Area, and in Building 996 (Corridor B and Building 996).

REQUIRED ACTIONS:

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Automatic Sprinkler System not OPERABLE in Building 991 Office Areas.	A.1	Establish a fire watch in accordance with Site requirements in Building 991 Office Areas.	4 hours.
	AND		
	A.2	Terminate all hot work in the Office Areas.	2 hours.
B. Automatic Sprinkler System not OPERABLE in areas other than the Building 991 Office Area.	B.1	Establish a fire watch in accordance with Site requirements in AFFECTED AREAS.	4 hours.
	AND		
	B.2	SUSPEND OPERATIONS in AFFECTED AREAS.	4 hours.
C. Loss of Automatic Sprinkler System Flow Alarm transmittal capability to the Fire Department for Riser System A.	C.1	Establish a fire watch in accordance with Site requirements in AFFECTED AREAS.	4 hours.
	AND		
	C.2	Terminate all hot work in the Office Areas.	2 hours.
	AND		
	C.3	SUSPEND OPERATIONS in all other AFFECTED AREAS.	4 hours.

REQUIRED ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
D. Loss of Automatic Sprinkler System Flow Alarm transmittal capability to the Fire Department for Riser System B.	D.1 Establish a fire watch in accordance with Site requirements in AFFECTED AREAS. **AND** D.2 SUSPEND OPERATIONS in AFFECTED AREAS.	4 hours. 4 hours.
E. Loss of Smoke Detection Alarm transmittal capability to the Fire Department.	E.1 Establish a fire watch in accordance with Site requirements in AFFECTED AREAS. **AND** E.2 SUSPEND OPERATIONS in AFFECTED AREAS.	8 hours. 4 hours.

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3./4. LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

4.1 SURVEILLANCE REQUIREMENTS: BUILDING 991 COMPLEX AUTOMATIC SPRINKLER SYSTEMS AND FLOW/SMOKE DETECTION ALARMS

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.1.1	Verify correct positioning of post indicating valves (PIVs) and sprinkler control valves.	Once per month.
SR 4.1.2	Verify that the static pressures in Riser Systems A and B are greater than 27 psi.	Once per month.
SR 4.1.3	Verify that the air pressure in dry pipe Automatic Sprinkler System B is between 25 psig and 45 psig and verify that the air pressure in the dry pipe portion of Automatic Sprinkler System A is between 35 psig and 50 psig.	Once per month.
SR 4.1.4	Perform a main drain flow test at Riser Systems A and B.	Once per quarter.
SR 4.1.5	Perform a water flow alarm test at an inspector's test connection and verify Riser System A and B alarm transmittal to Fire Department.	Once per quarter.
SR 4.1.6	Perform visual inspection of Automatic Sprinkler Systems A and B.	Once per year.
SR 4.1.7	Perform operational test of dry pipe Automatic Sprinkler System B and the dry pipe portion of Automatic Sprinkler System A.	Once per year.
SR 4.1.8	Perform visual inspection of Smoke Detection Fire Alarm Panel and the facility Smoke Detectors.	Once per 6 months.
SR 4.1.9	Perform operational test of the Smoke Detection System and verify alarm transmittal to Fire Department.	Once per year.

3./4. LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3.1/4.1 BUILDING 991 COMPLEX AUTOMATIC SPRINKLER SYSTEMS AND FLOW/SMOKE DETECTION ALARMS

BASES

BACKGROUND

The BUILDING 991 COMPLEX handles and stores low-level waste (LLW) and TRU waste containers (including pipe overpack containers (POCs)) of various types. All POC containers are packaged in robust metal containers that are not susceptible to fire damage. All of the other waste containers inside the buildings are metal drums or metal crates. Wooden LLW crates are permitted to be stored outside of the buildings in areas covered by the Automatic Sprinkler System. The BUILDING 991 COMPLEX also handles and stages Type B shipping containers holding SNM for off-site shipment. All SNM containers are packaged in robust metal containers that are not susceptible to fire damage.

The combustible loading in the interior waste container storage areas of the BUILDING 991 COMPLEX is minimal, consisting of drum-protecting plywood sheets between drum tops and metal pallets in stacked drum configurations, crate-protecting plastic covers between stacked metal crates, and limited transient combustible materials. Wooden pallets are not permitted to be used for waste container storage in the BUILDING 991 COMPLEX. Exterior waste container storage areas of the BUILDING 991 COMPLEX potentially have a higher combustible loading (*e.g.*, empty wooden crates, wooden LLW crates).

Fires impacting waste containers were evaluated in the FSAR Safety Analysis. The analysis evaluated fires initiating in the interior waste container storage areas, the exterior wooden LLW crate storage areas, and the office areas which are contiguous to waste container storage areas. The Automatic Sprinkler System suppressed the growth of fires in each of the areas, excepting the Building 996 waste container storage area which is not covered by the Automatic Sprinkler System.

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BACKGROUND (continued)	The BUILDING 991 COMPLEX waste container storage areas (except for Building 996) are provided with Automatic Sprinkler System coverage. Automatic Sprinkler System A, in part, is a wet pipe system which covers the heated areas of Building 991 and Building 998 (Room 300 and Corridor A). The remainder of Automatic Sprinkler System A is a dry pipe system branching off of the wet pipe portion of Automatic Sprinkler System A and covers the Building 991 East Dock Canopy Area as well as Building 989 (diesel generator building, not a waste container storage area). Automatic Sprinkler System B is a dry pipe system and covers Room 170 and the Building 991 West Dock Canopy Area. Riser System A supports the wet pipe and dry pipe portions of Automatic Sprinkler System A. Riser System B supports the dry pipe Automatic Sprinkler System B. The remaining BUILDING 991 COMPLEX waste container storage area (*i.e.*, Building 996) is provided with a Smoke Detection System but is not covered by the Automatic Sprinkler Systems. The Flow Alarm Transmittal System consists of water-flow switches to detect Automatic Sprinkler System usage and to send an alarm signal to the Fire Dispatch Center (Fire Department) and the Central Alarm Station. The Smoke Detection System, located in some tunnels and vaults, sends an alarm signal to the Fire Department in the same manner as the sprinkler system flow alarm. Alarm functions have battery backup capacities of from four (4) to eight (8) hours for loss of power situations. Functional performance and maintenance expectations are established for these systems in Site procedures, which are based on accepted industry standards such as NFPA 25, *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems* (Ref. A-1), NFPA 72, *National Fire Alarm Code* (Ref. A-2); and NFPA 13, *Standard for the Installation of Sprinkler Systems* (Ref. A-3).
APPLICATION TO SAFETY ANALYSIS	The Automatic Sprinkler System is a recognized control credited in the analysis of postulated fire accident scenarios as indicated in Chapter 5, *Safety Structures, Systems, and Components*, of the FSAR. The Flow/Smoke Detection Alarm Transmittal Systems are a recognized control to mitigate fires larger than currently evaluated in the safety analysis.

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BASES

APPLICATION TO SAFETY ANALYSIS (CONT.)	The Automatic Sprinkler System provides a credited safety function to suppress postulated fires occurring in the BUILDING 991 COMPLEX Office Areas and reduce the likelihood that Office Area fires will impact waste container storage areas. The Automatic Sprinkler System is expected to actuate automatically and mitigate the Office Area fire to prevent fire propagation into contiguous waste container storage areas. The Automatic Sprinkler System also provides a credited safety function to mitigate the effects of any fires that may occur in waste container storage areas. An additional safety function is provided by the Flow Alarm Transmittal System which notifies the Fire Department of Automatic Sprinkler System actuation, initiating Fire Department response to extinguish the fire and mitigate any fire related impacts. The Smoke Detection Alarm Transmittal System provides a system to detect and report fires in non-sprinklered waste storage areas of the BUILDING 991 COMPLEX to facilitate response of the Fire Department. Receipt of the alarm from the Smoke Detection System will initiate Fire Department response to extinguish the fire and mitigate any fire related impacts. Receipt of the alarm from the Smoke Detection System will also facilitate initiation of an LS/DW announcement to notify personnel inside Building 991 of the fire.
LCO 3.1	The BUILDING 991 COMPLEX Automatic Sprinkler System and Flow/Smoke Detection Alarm Transmittal Systems shall be OPERABLE. For the Automatic Sprinkler System to be OPERABLE, the system must be capable of automatically supplying water to waste container storage areas and the Office Area of the BUILDING 991 COMPLEX sufficient to suppress fire growth in those areas following the initiation of fires with significant growth potential. For the Flow Alarm Transmittal System to be OPERABLE, the system must be capable of detecting Automatic Sprinkler System use and providing a signal to the Fire Dispatch Center and/or the Central Alarm Station. For the Smoke Detection Alarm Transmittal System to be OPERABLE, the system must be capable of detecting a fire and providing a signal to the Fire Dispatch Center and/or Central Alarm Station.
APPLICABILITY	This LCO is applicable to those portions of the BUILDING 991 COMPLEX that are waste container storage areas (*i.e.*, Building 991 waste container storage areas, Building 998 (Room 300 and Corridor A), the Building 991 West Dock Canopy Area, Building 996, and the Building 991 East Dock Canopy Area) and is applicable to the BUILDING 991 COMPLEX Office Area. The LCO is applicable at all times.

BASES

REQUIRED ACTION A.1

LCO 3.1 will not be met if the Automatic Sprinkler System is not OPERABLE in the BUILDING 991 COMPLEX Office Area. The absence of the sprinkler system function in the BUILDING 991 COMPLEX Office Area provides the potential for a small, Office Area fire to propagate into a fire that is large enough to impact the contiguous waste container storage area (*i.e.*, Room 134). The Automatic Sprinkler System functions to suppress the fire (*i.e.*, extinguish or keep the fire small) and to inform the Fire Department of the fire, via the Flow Alarm Transmittal System, which initiates potential Fire Department mitigation of the fire. Without the fire suppression function, the dependence on the Fire Department to mitigate fires is increased. The facility is still protected if there is a capability to notify the Fire Department of small fires prior to their becoming large fires.

If the Automatic Sprinkler System is not OPERABLE in the Office Area, the facility shall comply with Site requirements for establishing a fire watch in the Office Area within four-hours. If a fire watch is established, the fire watch partly replaces the fire detection and alarm functions of the Automatic Sprinkler and Flow Alarm Transmittal Systems with a fire watch individual capable of providing the functions during watch tours. The fire watch individual is expected to notify the Fire Department in the event of a fire, either via fire phones or an alternative method if the fire phones are unavailable. The Fire Department then provides a fire suppression function in lieu of the Automatic Sprinkler System in the Office Area.

The establishing of a fire watch in the Office Area does not provide full-time fire detection capability. A fire could initiate and propagate between tours of the fire watch. Because the fire watch does not monitor all areas continuously and, therefore, does not completely replace the fire detection and alarm capability of the Automatic Sprinkler and Flow Alarm Transmittal Systems, a reduction in fire initiating event or propagation frequency is warranted. REQUIRED ACTION A.2 is identified to reduce the likelihood of fire initiation in the Office Area.

While the fire watch does not provide the full-time fire detection capability afforded by an OPERABLE Automatic Sprinkler System (and integral Flow Alarm Transmittal System), the fire watch individual has the capability to detect fires well in advance of the actuation of the Automatic Sprinkler System. This earlier fire detection capability partially offsets the non-continuous coverage of the fire watch.

BASES

REQUIRED ACTION A.1 (continued)	The four-hour COMPLETION TIME for determining and establishing a fire watch in accordance with Site requirements provides adequate time for facility management to assign the appropriate personnel, particularly on back shifts and weekends. Occupants of the facility can perform the fire watch function. The four-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire. However, the REQUIRED ACTION to establish a fire watch in accordance with Site requirements is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION A.2	LCO 3.1 will not be met if the Automatic Sprinkler System is not OPERABLE in the BUILDING 991 COMPLEX Office Area. The absence of the sprinkler system function in the BUILDING 991 COMPLEX Office Area provides the potential for a small, Office Area fire to propagate into a fire that is large enough to impact the contiguous waste container storage area (*i.e.*, Room 134). The Automatic Sprinkler System functions to suppress the fire (*i.e.*, extinguish or keep the fire small) and to inform the Fire Department of the fire, via the Flow Alarm Transmittal System, which initiates potential Fire Department mitigation of the fire. Without the fire suppression function, the likelihood of large fires is increased. The facility is still protected if the likelihood of fire initiation is decreased sufficiently to offset the increased likelihood of large fires. If the Automatic Sprinkler System is not OPERABLE in the Office Area, the facility shall terminate all hot work being conducted in the Office Area within two-hours. The termination of hot work (*i.e.*, spark/heat/flame producing work but not normal office activities) is a measure to reduce the likelihood of fire initiation in the Office Area. The termination does not replace the fire suppression or the fire detection and alarm functions of the Automatic Sprinkler and Flow Alarm Transmittal Systems but attempts to maintain an equivalent risk by reducing fire frequency. The termination of hot work does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. Therefore, REQUIRED ACTION A.1 is identified to provide some fire detection and alarm capability while the Automatic Sprinkler System is not OPERABLE. The fire watch established in REQUIRED ACTION A.1 can continue to verify that hot work is terminated while performing tours. The two-hour COMPLETION TIME associated with the termination of hot work provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work. The termination of these activities does not negate any fire watch requirements associated with the original activity. That is, if the hot work permit stipulated a continuous fire watch for eight hours to monitor equipment while it is cooling, the termination of the activity would not relax the requirement for a continuous fire watch.

REQUIRED ACTION A.2 (continued)	The two-hour COMPLETION TIME does not result in undue risk due to the already continuous monitoring of the activities by the workers involved in the activities. However, the REQUIRED ACTION to terminate all hot work in the Office Area is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The two-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION B.1	LCO 3.1 will not be met if the Automatic Sprinkler System is not OPERABLE in waste container storage areas of the BUILDING 991 COMPLEX. The absence of the sprinkler system function in BUILDING 991 COMPLEX waste container storage areas provides the potential for a fire impacting a limited number of waste containers, if any, to propagate into a fire impacting larger numbers of waste containers. The Automatic Sprinkler System functions to mitigate the fire consequences (*i.e.*, keep the number of waste containers impacted small) and to inform the Fire Department of the fire, via the Flow Alarm Transmittal System, which initiates potential Fire Department mitigation of the fire. Without the fire suppression function, the dependence on the Fire Department to mitigate fires is increased. The facility is still protected if there is a capability to notify the Fire Department of small fires prior to their becoming large fires. If the Automatic Sprinkler System is not OPERABLE in waste container storage areas, the facility shall comply with Site requirements for establishing a fire watch in the AFFECTED AREAS within four-hours. If a fire watch is established, the fire watch partly replaces the fire detection and alarm functions of the Automatic Sprinkler and Flow Alarm Transmittal Systems with a fire watch individual capable of providing the functions during watch tours. The fire watch individual is expected to notify the Fire Department in the event of a fire, either via fire phones or an alternative method if the fire phones are unavailable. The Fire Department then provides a fire suppression function in lieu of the Automatic Sprinkler System in the waste container storage areas. The establishing of a fire watch in the AFFECTED AREAS does not provide full-time fire detection capability. A fire could initiate and propagate between tours of the fire watch. Because the fire watch does not monitor all areas continuously and, therefore, does not completely replace the fire detection and alarm capability of the Automatic Sprinkler and Flow Alarm Transmittal Systems, a reduction in fire initiating event or propagation frequency is warranted. REQUIRED ACTION B.2 is identified to reduce the likelihood of fire initiation in the AFFECTED AREAS.

REQUIRED ACTION B.1 (continued)	While the fire watch does not provide the full-time fire detection capability afforded by an OPERABLE Automatic Sprinkler System (and integral Flow Alarm Transmittal System), the fire watch individual has the capability to detect fires well in advance of the actuation of the Automatic Sprinkler System, particularly in waste container storage areas with high ceilings (*e.g.*, Room 134, Room 166, Room 170, Building 991 West Dock Canopy Area). This earlier fire detection capability partially offsets the non-continuous coverage of the fire watch. The four-hour COMPLETION TIME for determining and establishing a fire watch in accordance with Site requirements provides adequate time for facility management to assign the appropriate personnel, particularly on back shifts and weekends. Occupants of the facility can perform the fire watch function. The four-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire, particularly in waste container storage areas. However, the REQUIRED ACTION to establish a fire watch in accordance with Site requirements is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION B.2	LCO 3.1 will not be met if the Automatic Sprinkler System is not OPERABLE in waste container storage areas of the BUILDING 991 COMPLEX. The absence of the sprinkler system function in BUILDING 991 COMPLEX waste container storage areas provides the potential for a fire impacting a limited number of waste containers, if any, to propagate into a fire impacting larger numbers of waste containers. The Automatic Sprinkler System functions to mitigate the fire consequences (*i.e.*, keep the number of waste containers impacted small) and to inform the Fire Department of the fire, via the Flow Alarm Transmittal System, which initiates potential Fire Department mitigation of the fire. Without the fire suppression function, the likelihood of large fires is increased. The facility is still protected if the likelihood of fire initiation is decreased sufficiently to offset the increased likelihood of large fires. If the Automatic Sprinkler System is not OPERABLE in waste container storage areas, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four-hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of fire initiation in the AFFECTED AREAS The suspension of operations does not replace the fire suppression or the fire detection and alarm functions of the Automatic Sprinkler and Flow Alarm Transmittal Systems but attempts to maintain an equivalent risk by reducing fire frequency. The suspension of operations does not preclude fire initiation Energized electrical systems in the facility always have the potential to initiate fires. Therefore, REQUIRED ACTION B.1 is identified to provide some fire detection and alarm capability while the Automatic Sprinkler System is not OPERABLE. The fire watch established in REQUIRED ACTION B.1 can continue to verify that operations are suspended while performing tours.

REQUIRED ACTION B.2 (continued)	The four-hour COMPLETION TIME associated with the SUSPEND OPERATIONS REQUIRED ACTION provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work. The termination of these activities does not negate any fire watch requirements associated with the original activities. That is, if the hot work permit stipulated a continuous fire watch for eight hours to monitor equipment while it is cooling, the termination of the activity would not relax the requirement for a continuous fire watch. The four-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire, particularly in waste container storage areas, and due to the already continuous monitoring of the activities by the workers involved in the activities. However, the REQUIRED ACTION to SUSPEND OPERATIONS in AFFECTED AREAS is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION C.1	LCO 3.1 will not be met if the Flow Alarm Transmittal System is not OPERABLE for Riser System A. The absence of the fire detection and alarm function in the BUILDING 991 COMPLEX waste container storage areas covered by Riser System A and the Office Area reduces the likelihood that the Fire Department will be notified that a fire and/or actuation of the Automatic Sprinkler System has occurred. The Fire Department serves a DEFENSE-IN-DEPTH protection function in mitigating fires in the facility. The Fire Department also serves to mitigate facility flooding and water damage due to actuation of the Automatic Sprinkler System. Without the fire detection and alarm function, the likelihood of Fire Department response is decreased. The facility will maintain the same level of DEFENSE-IN-DEPTH mitigation protection if there is a capability to notify the Fire Department of small fires prior to their becoming large fires. If the Flow Alarm Transmittal System is not OPERABLE for Riser System A, the facility shall comply with Site requirements for establishing a fire watch in the AFFECTED AREAS within four-hours. If a fire watch is established, the fire watch partly replaces the fire detection and alarm functions of the Flow Alarm Transmittal Systems with a fire watch individual capable of providing the functions during watch tours. The fire watch individual is expected to notify the Fire Department in the event of a fire, either via fire phones or an alternative method if the fire phones are unavailable. The Fire Department then provides a DEFENSE-IN-DEPTH fire suppression function in addition to the Automatic Sprinkler System.

REQUIRED ACTION C.1 (continued)

The establishing of a fire watch in the AFFECTED AREAS does not provide full-time fire detection and alarm capability. A fire could initiate and propagate between tours of the fire watch. Because the fire watch does not monitor all areas continuously and, therefore, does not completely replace the fire detection and alarm capability of the Flow Alarm Transmittal Systems, a reduction in fire initiating event or propagation frequency is warranted. REQUIRED ACTION C.2 is identified to reduce the likelihood of fire initiation in the Office Area. REQUIRED ACTION C.3 is identified to reduce the likelihood of fire initiation in the other AFFECTED AREAS.

While the fire watch does not provide the full-time fire detection and alarm capability afforded by an OPERABLE Flow Alarm Transmittal System, the fire watch individual has the capability to detect fires well in advance of the actuation of the Automatic Sprinkler System. This earlier fire detection capability partially offsets the non-continuous coverage of the fire watch.

The four-hour COMPLETION TIME for determining and establishing a fire watch in accordance with Site requirements provides adequate time for facility management to assign the appropriate personnel, particularly on back shifts and weekends. Occupants of the facility can perform the fire watch function. The four-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire. However, the REQUIRED ACTION to establish a fire watch in accordance with Site requirements is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.

REQUIRED ACTION C.2

LCO 3.1 will not be met if the Flow Alarm Transmittal System is not OPERABLE for Riser System A which covers the Office Area. The absence of the fire detection and alarm function in the BUILDING 991 COMPLEX Office Area reduces the likelihood that the Fire Department will be notified that a fire and/or actuation of the Automatic Sprinkler System has occurred. The Fire Department serves a DEFENSE-IN-DEPTH protection function in mitigating fires in the facility. The Fire Department also serves to mitigate facility flooding and water damage due to actuation of the Automatic Sprinkler System. Without the fire detection and alarm function, the likelihood of Fire Department response is decreased. The loss of this DEFENSE-IN-DEPTH mitigation function tends to slightly increase the likelihood of large fires. The facility is still protected if the likelihood of fire initiation is decreased to offset the slightly increased likelihood of large fires.

REQUIRED ACTION C.2 (continued)

If the Flow Alarm Transmittal System is not OPERABLE for Riser System A, the facility shall terminate all hot work being conducted in the Office Area within two-hours. The termination of hot work (*i.e.*, spark/heat/flame producing work but not normal office activities) is a measure to reduce the likelihood of fire initiation in the Office Area. The termination does not replace the fire detection and alarm functions of the Flow Alarm Transmittal Systems but attempts to maintain an equivalent risk by reducing fire frequency. The termination of hot work does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. Therefore, REQUIRED ACTION C.1 is identified to provide some fire detection and alarm capability capability while the DEFENSE-IN-DEPTH mitigation function is not OPERABLE. The fire watch established in REQUIRED ACTION C.1 can continue to verify that hot work is terminated while performing tours.

The two-hour COMPLETION TIME associated with the termination of hot work provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work. The termination of these activities does not negate any fire watch requirements associated with the original activity. That is, if the hot work permit stipulated a continuous fire watch for eight hours to monitor equipment while it is cooling, the termination of the activity would not relax the requirement for a continuous fire watch.

The two-hour COMPLETION TIME does not result in undue risk due to the already continuous monitoring of the activities by the workers involved in the activities. However, the REQUIRED ACTION to terminate all hot work in the Office Area is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The two-hour COMPLETION TIME should not be used for operational convenience.

REQUIRED ACTION C.3

LCO 3.1 will not be met if the Flow Alarm Transmittal System is not OPERABLE for Riser System A. The absence of the fire detection and alarm function in the BUILDING 991 COMPLEX waste container storage areas covered by Riser System A reduces the likelihood that the Fire Department will be notified that a fire and/or actuation of the Automatic Sprinkler System has occurred. The Fire Department serves a DEFENSE-IN-DEPTH protection function in mitigating fires in the facility. The Fire Department also serves to mitigate facility flooding and water damage due to actuation of the Automatic Sprinkler System. Without the fire detection and alarm function, the likelihood of Fire Department response is decreased. The loss of this DEFENSE-IN-DEPTH mitigation function tends to slightly increase the likelihood of large fires. The facility is still protected if the likelihood of fire initiation is decreased to offset the slightly increased likelihood of large fires.

REQUIRED ACTION C.3 (continued)	If the Flow Alarm Transmittal System is not OPERABLE for Riser System A, the facility shall SUSPEND OPERATIONS in the waste container storage AFFECTED AREAS within four-hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of fire initiation in the waste container storage AFFECTED AREAS. The suspension of operations does not replace the fire detection and alarm functions of the Flow Alarm Transmittal System but attempts to maintain an equivalent risk by reducing fire frequency. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. Therefore, REQUIRED ACTION C.1 is identified to provide some fire detection and alarm capability while the DEFENSE-IN-DEPTH mitigation function is not OPERABLE. The fire watch established in REQUIRED ACTION C.1 can continue to verify that operations are suspended while performing tours. The four-hour COMPLETION TIME associated with the SUSPEND OPERATIONS REQUIRED ACTION provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work. The termination of these activities does not negate any fire watch requirements associated with the original activity. That is, if the hot work permit stipulated a continuous fire watch for eight hours to monitor equipment while it is cooling, the termination of the activity would not relax the requirement for a continuous fire watch. The four-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire, particularly in waste container storage areas, and due to the already continuous monitoring of the activities by the workers involved in the activities. However, the REQUIRED ACTION to SUSPEND OPERATIONS in waste container storage AFFECTED AREAS is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION D.1	LCO 3.1 will not be met if the Flow Alarm Transmittal System is not OPERABLE for Riser System B. The absence of the fire detection and alarm function in the BUILDING 991 COMPLEX waste container storage areas covered by Riser System B reduces the likelihood that the Fire Department will be notified that a fire and/or actuation of the Automatic Sprinkler System has occurred. The Fire Department serves a DEFENSE-IN-DEPTH protection function in mitigating fires in the facility. The Fire Department also serves to mitigate facility flooding and water damage due to actuation of the Automatic Sprinkler System. Without the fire detection and alarm function, the likelihood of Fire Department response is decreased. The facility will maintain the same level of DEFENSE-IN-DEPTH mitigation protection if there is a capability to notify the Fire Department of small fires prior to their becoming large fires.

REQUIRED ACTION D.1 (continued)

If the Flow Alarm Transmittal System is not OPERABLE for Riser System B, the facility shall comply with Site requirements for establishing a fire watch in the AFFECTED AREAS within four-hours. If a fire watch is established, the fire watch partly replaces the fire detection and alarm functions of the Flow Alarm Transmittal Systems with a fire watch individual capable of providing the functions during watch tours. The fire watch individual is expected to notify the Fire Department in the event of a fire, either via fire phones or an alternative method if the fire phones are unavailable. The Fire Department then provides a DEFENSE-IN-DEPTH fire suppression function in addition to the Automatic Sprinkler System.

The establishing of a fire watch in the AFFECTED AREAS does not provide full-time fire detection and alarm capability. A fire could initiate and propagate between tours of the fire watch. Because the fire watch does not monitor all areas continuously and, therefore, does not completely replace the fire detection and alarm capability of the Flow Alarm Transmittal Systems, a reduction in fire initiating event or propagation frequency is warranted. REQUIRED ACTION D.2 is identified to reduce the likelihood of fire initiation in the AFFECTED AREAS.

While the fire watch does not provide the full-time fire detection and alarm capability afforded by an OPERABLE Flow Alarm Transmittal System, the fire watch individual has the capability to detect fires well in advance of the actuation of the Automatic Sprinkler System. This earlier fire detection capability partially offsets the non-continuous coverage of the fire watch.

The four-hour COMPLETION TIME for determining and establishing a fire watch in accordance with Site requirements provides adequate time for facility management to assign the appropriate personnel, particularly on back shifts and weekends. Occupants of the facility can perform the fire watch function. The four-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire, particularly in waste container storage areas. However, the REQUIRED ACTION to establish a fire watch in accordance with Site requirements is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.

REQUIRED ACTION D.2

LCO 3.1 will not be met if the Flow Alarm Transmittal System is not OPERABLE for Riser System B. The absence of the fire detection and alarm function in the BUILDING 991 COMPLEX waste container storage areas covered by Riser System B reduces the likelihood that the Fire Department will be notified that a fire and/or actuation of the Automatic Sprinkler System has occurred. The Fire Department serves a DEFENSE-IN-DEPTH protection function in mitigating fires in the facility. The Fire Department also serves to mitigate facility flooding and water damage due to actuation of the Automatic Sprinkler System. Without the fire detection and alarm function, the likelihood of Fire Department response is decreased. The loss of this DEFENSE-IN-DEPTH mitigation function tends to slightly increase the likelihood of large fires. The facility is still protected if the likelihood of fire initiation is decreased to offset the slightly increased likelihood of large fires.

If the Flow Alarm Transmittal System is not OPERABLE for Riser System B, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four-hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of fire initiation in the AFFECTED AREAS. The suspension of operations does not replace the fire detection and alarm functions of the Flow Alarm Transmittal System but attempts to maintain an equivalent risk by reducing fire frequency. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. Therefore, REQUIRED ACTION D.1 is identified to provide some fire detection and alarm capability while the DEFENSE-IN-DEPTH mitigation function is not OPERABLE. The fire watch established in REQUIRED ACTION D.1 can continue to verify that operations are suspended while performing tours.

The four-hour COMPLETION TIME associated with the SUSPEND OPERATIONS REQUIRED ACTION provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work. The termination of these activities does not negate any fire watch requirements associated with the original activity. That is, if the hot work permit stipulated a continuous fire watch for eight hours to monitor equipment while it is cooling, the termination of the activity would not relax the requirement for a continuous fire watch.

The four-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire, particularly in waste container storage areas, and due to the already continuous monitoring of the activities by the workers involved in the activities. However, the REQUIRED ACTION to SUSPEND OPERATIONS in AFFECTED AREAS is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.

BASES

REQUIRED ACTION E.1

LCO 3.1 will not be met if the Smoke Detection Alarm Transmittal System is not OPERABLE. The absence of the fire detection and alarm function in the BUILDING 991 COMPLEX waste container storage area (i.e., Building 996 and Corridor B) reduces the likelihood that the Fire Department will be notified that a fire has occurred in this area. The Fire Department serves a credited protection function in mitigating fires in the facility. Without the fire detection and alarm function, the likelihood of Fire Department response is decreased. The Smoke Detection Alarm Transmittal System is only credited for those smoke detectors in Corridor B and in Building 996.

If the Smoke Detection Alarm Transmittal System is not OPERABLE, the facility shall comply with Site requirements for establishing a fire watch in the AFFECTED AREAS within eight-hours. If a fire watch is established, the fire watch partly replaces the fire detection and alarm functions of the Smoke Detection Alarm Transmittal System with a fire watch individual capable of providing the functions during watch tours. The fire watch individual is expected to notify the Fire Department in the event of a fire, either via fire phones or an alternative method if the fire phones are unavailable.

The establishing of a fire watch in the AFFECTED AREAS does not provide full-time fire detection and alarm capability. A fire could initiate and propagate between tours of the fire watch. Because the fire watch does not monitor all areas continuously and, therefore, does not completely replace the fire detection and alarm capability of the Smoke Detection Alarm Transmittal System, a reduction in fire initiating event or propagation frequency is warranted. REQUIRED ACTION E.2 is identified to reduce the likelihood of fire initiation in the AFFECTED AREAS.

While the fire watch does not provide the full-time fire detection and alarm capability afforded by an OPERABLE Smoke Detection Alarm Transmittal System, the fire watch individual has the capability to detect fires during early development. This earlier fire detection capability partially offsets the non-continuous coverage of the fire watch.

The eight-hour COMPLETION TIME for determining and establishing a fire watch in accordance with Site requirements provides adequate time for facility management to assign the appropriate personnel, particularly on back shifts and weekends. The additional time is necessary for Building 996 since this area is a vault and only personnel authorized to open the vault doors can be assigned to accomplish the fire watch. The eight-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire, particularly in waste container storage areas. However, the REQUIRED ACTION to establish a fire watch in accordance with Site requirements is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The eight-hour COMPLETION TIME should not be used for operational convenience.

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BASES

REQUIRED ACTION E.2	LCO 3.1 will not be met if the Smoke Detection Alarm Transmittal System is not OPERABLE. The absence of the fire detection and alarm function in the BUILDING 991 COMPLEX waste container storage areas reduces the likelihood that the Fire Department will be notified that a fire has occurred. The Fire Department serves a credited protection function in mitigating fires in the facility. Without the fire detection and alarm function, the likelihood of Fire Department response is decreased. The loss of this credited mitigation function tends to slightly increase the likelihood of large fires. The facility is still protected if the likelihood of fire initiation is decreased to offset the slightly increased likelihood of large fires. If the Smoke Detection Alarm Transmittal System is not OPERABLE, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four-hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of fire initiation in the AFFECTED AREAS. The suspension of operations does not replace the fire detection and alarm functions of the Smoke Detection Alarm Transmittal System but attempts to maintain an equivalent risk by reducing fire frequency. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. Therefore, REQUIRED ACTION E.1 is identified to provide some fire detection and alarm capability while the DEFENSE-IN-DEPTH mitigation function is not OPERABLE. The fire watch established in REQUIRED ACTION E.1 can continue to verify that operations are suspended while performing tours. The four-hour COMPLETION TIME associated with the SUSPEND OPERATIONS REQUIRED ACTION provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work. The termination of these activities does not negate any fire watch requirements associated with the original activity. That is, if the hot work permit stipulated a continuous fire watch for eight hours to monitor equipment while it is cooling, the termination of the activity would not relax the requirement for a continuous fire watch. The four-hour COMPLETION TIME does not result in undue risk due to the low initiation frequency of a fire, particularly in waste container storage areas, and due to the already continuous monitoring of the activities by the workers involved in the activities. However, the REQUIRED ACTION to SUSPEND OPERATIONS in AFFECTED AREAS is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.

SURVEILLANCE REQUIREMENTS BASES

SR 4.1.1	The verification of the correct positioning of control valves in the fire water supply to the BUILDING 991 COMPLEX assures, in part, the OPERABILITY of the Automatic Sprinkler System, including the Dry Pipe Systems which are sub-components of the entire system. The SR to verify valve positioning on a monthly interval satisfies several of the requirements found in NFPA 25. If SR 4.1.1 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on the finding.
SR 4.1.2	The verification of adequate static pressure (*i.e.*, greater than 27 psi) in the Riser Systems assures, in part, the OPERABILITY of the Automatic Sprinkler System. The SR to verify riser static pressure on a monthly interval satisfies a requirement found in NFPA 25. If SR 4.1.2 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on the finding.
SR 4.1.3	The verification of adequate air pressure in the dry pipe portions of the Automatic Sprinkler System (*i.e.*, between 25 psig and 45 psig in System B and between 35 psig and 50 psig in System A) assures, in part, the OPERABILITY of the dry pipe portions of the Automatic Sprinkler Systems. The SR to verify dry pipe air pressure on a monthly interval satisfies a requirement found in NFPA 25. If SR 4.1.3 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on the finding.
SR 4.1.4	The performance of a main drain flow test on the Riser Systems assures, in part, the OPERABILITY of the Automatic Sprinkler System. The SR to test main drain flow on a quarterly interval satisfies a requirement found in NFPA 25. If SR 4.1.4 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on the finding.
SR 4.1.5	The performance of a water flow alarm test at an inspector's test connection and verification of the Riser System flow alarm transmittal assures that the Flow Alarm Transmittal System is functioning. The SR to test the water flow alarm on a quarterly interval satisfies a requirement found in NFPA 25 and NFPA 72. If SR 4.1.5 is not met, entry into LCO CONDITION C or LCO CONDITION D is expected, depending on the finding.
SR 4.1.6	The performance of a visual inspection of the Automatic Sprinkler Systems assures, in part, the OPERABILITY of the Automatic Sprinkler Systems. The SR to visually inspect the systems annually satisfies a requirement found in NFPA 25. If SR 4.1.6 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on the finding.

SURVEILLANCE REQUIREMENTS BASES

SR 4.1.7	The performance of an operational test of the dry pipe portions of the Automatic Sprinkler Systems assures, in part, the OPERABILITY of the dry pipe portions of the Automatic Sprinkler Systems. The SR to test the dry pipe systems annually satisfies a requirement found in NFPA 25. If SR 4.1.7 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on the finding.
SR 4.1.8	The performance of a visual inspection of the Smoke Detection Fire Alarm Panel and facility Smoke Detectors assures, in part, the OPERABILITY of the Smoke Detection System. The SR to visually inspect the fire alarm panel and facility smoke detectors for indicator light operation, proper configuration, and damage semi-annually satisfies a requirement found in NFPA 72. If SR 4.1.8 is not met, entry into LCO CONDITION E is expected, depending on the finding.
SR 4.1.9	The performance of an operational test of the Smoke Detection System assures, in part, the OPERABILITY of the smoke detectors and alarm transmittal. The SR to operationally test the smoke detectors, the Smoke Detection System Fire Alarm Panel, and alarm transmittal annually satisfies a requirement found in NFPA 72. If SR 4.1.9 is not met, entry into LCO CONDITION E is expected, depending on the finding.

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3./4. LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3.2 LIMITING CONDITION FOR OPERATION: BUILDING 991 COMPLEX FILTERED EXHAUST VENTILATION SYSTEMS

LCO: The BUILDING 991 COMPLEX Filtered Exhaust Ventilation Systems Shall Be OPERABLE, With The Following:

1. The High Efficiency Particulate Air (HEPA) filter stage in the Building 991 exhaust ventilation system plenum shall have an efficiency ≥ 99.9%.
2. At least one HEPA filter stage in the Building 985 exhaust ventilation system shall have an efficiency ≥ 99.9%, if the system is intended to be used.
3. The Building 991 exhaust ventilation system plenum shall be at a differential pressure ≥ 0.5 in. water gauge (w.g.) negative with respect to atmospheric reference and shall have a differential pressure across the plenum ≤ 4 in. w.g. negative.
4. Room 170 shall be at a differential pressure ≥ 0.02 in. w.g. negative with respect to atmospheric reference when dock doors are closed.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX interior container storage/staging areas other than Room 166. Differential pressure requirements are not applicable for normal differential pressure fluctuations (≤ 5 minutes in duration). Room 170 differential pressure requirements are not applicable during receipt and shipment operations in Room 170.

The SUSPEND OPERATIONS REQUIRED ACTIONS included in LCO 3.2 do not include suspension of operations involving movement of Type B shipping containers or Pipe Overpack Containers (POCs) and do not include transfer of any containers staged for shipment in Room 170 to a transport vehicle at the Room 170 dock.

REQUIRED ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Loss of off-site power to the BUILDING 991 COMPLEX exhaust ventilation systems.	A.1 SUSPEND OPERATIONS in the AFFECTED AREAS.	4 hours.
B. Degradation or loss of the Building 991 exhaust ventilation system filtration capability.	B.1 SUSPEND OPERATIONS in the AFFECTED AREAS.	4 hours.

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REQUIRED ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Degradation or loss of the Building 985 exhaust ventilation system filtration capability.	C.1 SUSPEND OPERATIONS in the AFFECTED AREAS. **OR** C.2 Stop operation of Building 985 exhaust ventilation system main exhaust fans.	4 hours. 2 hours.
D. Differential pressure in the Building 991 exhaust ventilation system plenum is < 0.5 in. w.g. negative with respect to atmospheric reference.	D.1 SUSPEND OPERATIONS in the AFFECTED AREAS.	4 hours.
E. Differential pressure in Room 170 is < 0.02 in. w.g. negative with respect to atmospheric reference.	E.1 SUSPEND OPERATIONS in Rooms 134, 135, 147, and 170.	4 hours.
F. Differential pressure across the Building 991 exhaust ventilation system plenum is > 4 in. w.g. negative.	F.1 SUSPEND OPERATIONS in the AFFECTED AREAS.	4 hours.

3./4. LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

4.2 SURVEILLANCE REQUIREMENTS: BUILDING 991 COMPLEX FILTERED EXHAUST VENTILATION SYSTEM

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.2.1	Verify that the removal efficiency is ≥ 99.9% for the Building 991 exhaust ventilation system HEPA filter stage.	Once per 18 months.
SR 4.2.2	As long as the Building 985 exhaust ventilation system is intended to be used, verify that the removal efficiency is ≥ 99.9% for a Building 985 exhaust ventilation system HEPA filter stage.	Once per 18 months.
SR 4.2.3	Verify that the pressure differential in the Building 991 exhaust ventilation system plenum is ≥ 0.5 in. w.g. negative with respect to atmospheric reference.	Once per working shift.
SR 4.2.4	Verify that the pressure differential in Room 170 is ≥ 0.02 in. w.g. negative with respect to atmospheric reference.	Once per working shift and upon completion of receipt or shipment operations in Room 170 (*i.e.*, closing dock door).
SR 4.2.5	Verify that the pressure differential across the Building 991 exhaust ventilation system plenum is ≤ 4 in. w.g. negative.	Once per working shift.

3./4. LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3.2/4.2 BUILDING 991 COMPLEX FILTERED EXHAUST VENTILATION SYSTEM

BASES

BACKGROUND

The BUILDING 991 COMPLEX handles and stores low-level waste (LLW) and TRU waste containers (including pipe overpack containers (POCs)) of various types. All POC containers are packaged in robust metal containers that are not vulnerable to most accident scenarios. All of the other waste containers inside the buildings are metal drums or metal crates. Wooden LLW crates are permitted to be stored outside of the buildings. The BUILDING 991 COMPLEX also handles and stages Type B shipping containers holding SNM for off-site shipment. All SNM containers are packaged in robust metal containers that are not vulnerable to most accident scenarios.

The Building 991 filtered exhaust ventilation system (FEVS) consists of a Building 991 rooftop main exhaust plenum, three main exhaust fans, a set of smaller exhaust fans that discharge into the main exhaust plenum, and associated ducting. A single main exhaust fan provides sufficient flow to maintain negative differential pressures, with respect to atmosphere, in the areas of confinement. A standby main exhaust fan must be started manually upon failure of the running exhaust fan. All building exhaust and supply fans will shut off if no main exhaust fans are running. Several of the small exhaust fans are not operational.

The main exhaust plenum contains a single stage of High Efficiency Particulate Air (HEPA) filtration composed of 96 filters, a mist eliminator, and a plenum deluge system. There is instrumentation indicating the differential pressure between the inlet and outlet portions of the plenum (across the stage of HEPA filtration) and instrumentation indicating the differential pressure between the inlet portion of the plenum and an atmospheric reference (building exterior air pressure). Heat sensors in the inlet ducting of the plenum alarm at the fire department and automatically initiate the plenum deluge system when sensor temperature setpoints are exceeded and filters are threatened.

The FEVS is dedicated to supporting the north areas of Building 991 and the Building 998 connecting tunnel. The south areas (*i.e.*, Rooms 134, 135, 147, and 170) of Building 991, Building 996, and the Corridor B tunnel are indirectly supported, to varying extents, by the FEVS. Room 166 is not supported at all by the FEVS. The FEVS, in conjunction with the facility structure provides a confinement zone in most of the container storage/staging areas of Building 991 and the connecting tunnels.

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BASES

BACKGROUND (continued)

The Building 985 filtered exhaust ventilation system consists of a main exhaust plenum, two exhaust fans, and associated ducting. A single exhaust fan provides sufficient flow to maintain negative differential pressures, with respect to atmosphere, in the supported areas of confinement.

The Building 985 exhaust plenum contains two stages of HEPA filtration composed of 20 filters per stage, a mist eliminator, and a plenum deluge system. There is instrumentation indicating the differential pressure across each stage of HEPA filtration. Heat sensors in the inlet ducting of the plenum alarm at the fire department and automatically initiate the plenum deluge system when sensor temperature setpoints are exceeded and filters are threatened.

The ventilation system in Building 985 is dedicated to supporting Building 996, Building 997, Building 999, the Corridor B tunnel, and the Corridor C tunnel. When both the FEVS and the Building 985 exhaust ventilation system are operating, some air from the east-west running corridor in the north area of Building 991 is drawn into the Building 985 exhaust. This provides an exhaust path from some container storage/staging areas that does not go through the FEVS. In order to ensure that all forced exhaust paths from the container storage/staging areas are filtered, either the Building 985 ventilation system must not be operating (removes the forced exhaust path) or the Building 985 ventilation system stages of HEPA filters must be verified to provide the same filtering efficiency as the FEVS filter stage.

If the Building 985 ventilation system is not operating, the FEVS will generate a negative pressure in the areas normally supported by the Building 985 ventilation system via the connection from Corridor B to the north area of Building 991. The door from Corridor B to the west canopy area is not expected to be used for normal operations. If the door is opened and the Building 985 ventilation system is not operating, Building 996 and Corridor B may no longer be at a desirable negative pressure.

Operation of the Building 985 ventilation system may be required for a short period of time prior to and during entry into Corridor B, Building 996, Corridor C, Building 999, and Building 997. The system operation may stem from Safety and Industrial Hygiene Program confined space entry requirements. This is due to the vault-type door located in Corridor B which separates the tunnel confined spaces from the Building 991 FEVS. Air in the tunnels and connecting buildings would be stagnate since there is no impetus for air circulation other than that provided by the Building 985 ventilation system.

BASES

BACKGROUND (continued)

The south waste container storage areas, Rooms 134, 135, 147, and 170, are maintained at a negative pressure due to their connection to the north areas of Building 991 and the FEVS. Room 170 is connected to Room 141 of the north area via a fire door. When the fire door is opened and the Room 170 dock doors are closed, Room 170 is at a desirable negative pressure relative to the building exterior atmospheric reference. Room 147 is connected to Room 170 and would have the same air pressure. Room 134 has a connection to Room 170 most of the time (the door between the rooms may be closed during Special Nuclear Material (SNM) movements of Type B shipping containers). Room 134, which includes Rooms 132 and 135, also has relatively minor connections to the FEVS via Rooms 132 and 135 (small rooms with normally closed door between the rooms and Room 134). There is the possibility of connecting Room 134 to the north area and the FEVS via the north-south running corridor if the airlock doors in the corridor are opened. The corridor doors are no longer needed to serve as an airlock.

Room 166 has no connection to the north area FEVS. This room is considered to have no filtered exhaust potential.

During shipping and receiving operations, the Room 170 dock doors are opened and Rooms 147 and 170 may no longer be at a desirable negative pressure. Under this configuration, there is an inflow of air from the outside into Room 170. As a conservative assumption, this air inflow is not considered to represent maintenance of the FEVS confinement zone in Rooms 147 and 170.

Configurations that do not yield desirable negative pressure in Rooms 147 and 170 result: 1) when Room 170 dock doors are opened (assumed to result in insufficient negative pressure even with the expected inflow of air); or 2) when Room 170 doors to Rooms 149, 140/141, and 134 are all closed (Room 170 isolated from Building 991 exhaust ventilation system). A configuration that does not yield desirable negative pressure in Rooms 134 and 135 results when the door between Room 170 and 134 is closed and the airlock doors in the north-south running corridor are closed (Room 134 isolated from Building 991 exhaust ventilation system).

Requirements dealing with the OPERABILITY of the FEVS are not as stringent as those found in Site facilities that process radioactive materials. Since the ventilated portion of the BUILDING 991 COMPLEX has not and does not process radioactive materials, there is negligible contamination present the facility. Therefore, operation of the FEVS is not needed to provide confinement for radioactive materials during normal operations. In Site facilities that process radioactive materials, the ventilation systems serve to confine in-process radioactive materials and contamination, requiring continuous and reliable operation of the ventilation systems.

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BASES

BACKGROUND (continued)	The Building 991 FEVS serves only to mitigate accidental releases of radioactive materials from spills, fires, *etc.*. Interruptions in FEVS operation do not present a challenge to the safety of the facility if actions are taken to SUSPEND OPERATIONS. Accident initiating event frequency is expected to drop significantly if no operations are being performed, reducing the need for the FEVS. In summary, since the FEVS does not perform a confinement function for in-process radioactive materials and contamination, requirements dealing with fan OPERABILITY (*e.g.*, bearing temperature, belt wear) or system reliability (*e.g.*, standby fans, number of fans operating) are not as necessary compared to other Site facilities. Continuous monitoring of FEVS OPERABILITY (*e.g.*, alarmed pressure gauges) is also not as necessary. Since accident initiation frequency during SUSPENDED OPERATIONS is expected to drop significantly compared to frequencies during the conduct of operations, the risk associated with an unreliable FEVS is low as long as operations are suspended in a reasonable time following loss of the FEVS (*i.e.*, within a shift justifying shiftly SURVEILLANCE of the function).
APPLICATION TO SAFETY ANALYSIS	The FEVS is a recognized control credited to mitigate the public and collocated worker radiological dose consequences for several dominant postulated accident scenarios as indicated in Chapter 5, *Safety Structures, Systems, and Components*, of the FSAR. The control was not credited as part of the accident analysis presented in the FSAR-supporting Nuclear Safety Technical Report (NSTR). Rather, the control was identified and credited as part of the dominant accident scenario discussions in Chapter 4, *Hazard and Accident Analysis Summary*, of the FSAR. The single stage of HEPA filtration, tested to provide at least 99.9% removal efficiency, is credited with reducing the building leakpath factor from 1.0 to 0.001. HEPA filtration provided by the FEVS, and by the Building 985 exhaust ventilation system when operating, is only applicable to accident scenarios that occur in the areas covered by the FEVS, that do not impact electric power, and that do not involve a failure of the facility structure. Therefore, the medium-large low level waste (LLW) container fire that occurs under the west canopy area, outside the building, cannot credit the FEVS as a mitigative system [not in area covered by the FEVS]. Also, the design basis earthquake accident scenario that results in failure of the electric power system cannot take advantage of the FEVS. Finally, the facility flammable gas explosion, the snow loading, and the beyond design basis earthquake accident scenarios, which may result in a breach of the facility structure, cannot claim mitigation by the system. Therefore, facility interior fires, spills, punctures, and container explosions have the potential to be mitigated by the FEVS.

BASES

APPLICATION TO SAFETY ANALYSIS (continued)

The facility flammable gas explosion dominant accident scenario presents low risk to the public and the collocated workers but high risk to the immediate worker. The FEVS does not mitigate accident consequences for the immediate worker Therefore, the dominant scenario risk aspects of the facility flammable gas explosion cannot be mitigated by the FEVS.

The radiological dose consequences of fire scenarios (other than those that occur at the dock during shipping or receiving) can be mitigated by the FEVS. During the conduct of the shipping and receiving activities, the Room 170 dock doors are open and the system is not credited for Room 147 or Room 170 accident mitigation. However, the likelihood of fires occurring in Room 147 or Room 170 during conduct of these activities is small compared to the likelihood of fires occurring during maintenance activities or during general, unattended waste container storage. This low fire likelihood is attributed to the constant personnel attendance during the conduct of the receipt and shipment activities and the absence of significant ignition sources in the Room 170 activities (use of electric forklifts and handcarts). Therefore, the bounding building interior fires that are evaluated in the safety analysis are considered to be mitigated by the FEVS.

The metal containers that are received by the facility for storage or staging are either Type A or Type B shipping containers. These containers are not vulnerable to falls of less than four feet or thirty feet, respectively. Therefore, the only spill vulnerability of the containers rests with the Type A containers that are lifted or stacked above four feet (*i.e.* third tier or higher). Stacking operations above the second tier are not conducted while the dock doors are open and the receiving and shipping activities are not expected to raise the containers above four feet Therefore, the building interior, normal operation spills that are evaluated in the safety analysis are mitigated by the FEVS.

Metal containers that are moved during operations are exposed to a potential for forklift tine punctures. These container puncture scenarios can occur while the dock doors are open during receipt and shipment operations or can occur while the dock doors are closed during other operations. Metal waste containers that are moved during operations create a potential for container hydrogen explosions each time the containers are touched. As in the case of the puncture accident scenarios, container hydrogen explosion scenarios can occur while the dock doors are open during receipt and shipment operations or can occur while the dock doors are closed during other operations.

BASES

APPLICATION TO SAFETY ANALYSIS (continued)	The FEVS is credited in combination with an AOL control to have the dock doors closed during all operations conducted in Room 170 except for receiving and shipping operations. It is intended that containers (other than SNM Type B shipping containers) will be immediately staged in Room 170 at receipt until the dock doors are closed. Following door closure, containers are moved to storage locations. Also, it is assumed that containers (other than SNM Type B shipping containers) will be staged in Room 170 in preparation for shipping prior to the dock doors being opened for placement on the transport vehicle.
LCO 3.2	The BUILDING 991 COMPLEX Filtered Exhaust Ventilation Systems Shall Be OPERABLE. For the FEVS to be OPERABLE, the system must maintain a negative pressure in the areas where container operations, other than receipt and shipment, are conducted. A negative pressure differential in the inlet portion of the Building 991 plenum indicates that an FEVS fan is operating. A negative differential pressure across the Building 991 plenum indicates that HEPA filters are providing resistance to flow and are present. If an FEVS fan is operating and the FEVS ductwork is relatively intact, the north container storage/staging areas and the Building 996 connected area will be at a negative pressure relative to an atmospheric reference. The south waste container storage area negative differential pressure must be verified independently due to the FEVS indirect, rather than direct, support of the south waste container storage areas. For the FEVS to be OPERABLE, the system must also filter facility exhaust air. If the Building 991 exhaust plenum filter stage efficiency has been verified, air exiting the facility via the Building 991 FEVS is filtered. If the Building 985 FEVS is utilized and one of the two exhaust plenum filter stage efficiency has been verified, air exiting the facility via the Building 985 FEVS is filtered.
APPLICABILITY	This LCO is applicable to those portions of the BUILDING 991 COMPLEX, other than Room 166, that are interior container storage/staging areas (*i.e.*, Building 991 north and south container storage/staging areas, Building 998 (Room 300 and Corridor A), and Building 996 (Building 996 and Corridor B)). The LCO is applicable at all times. Differential pressure requirements do not have to be maintained during normal differential pressure fluctuations of less than 5 minutes in duration. Wind conditions outside the facility may lead to differential pressure fluctuations. As long as the fluctuations are of a short duration, there is no indication that the system is not OPERABLE. The Room 170 pressure differential requirements do not have to be maintained while dock doors are open during receipt and shipment operations. The safety analysis evaluates accidents occurring while dock doors are open as unfiltered releases.

BASES

APPLICABILITY (continued)

The SUSPEND OPERATIONS REQUIRED ACTIONS for the FEVS LCO do not apply to operations involving the movement of SNM Type B shipping containers or POCs. The dominant accident scenarios that are evaluated crediting the filtered exhaust ventilation safety function do not involve POCs. These type of containers, along with Type B shipping containers, are not susceptible to any analyzed accident scenarios other than *extremely unlikely* container punctures. In the case of POCs, the container puncture scenario was not a dominant accident scenario. The Type B shipping container puncture scenario was a dominant accident scenario, but the only movements involving these containers are associated with container receipt for staging or container shipment. In both of these cases, the Room 170 dock doors are open and the functionality of the FEVS under that condition is unknown (*i.e.*, the level of filtration of accident scenario releases while dock doors are open is not known but an inflow of air into Room 170 is expected through the open door). OPERABILITY of the FEVS is not considered to be a concern during SNM Type B shipping container movements.

The SUSPEND OPERATIONS REQUIRED ACTIONS for the FEVS LCO also do not apply to operations associated with the transfer of previously staged waste containers in Room 170 to a transport vehicle at the Room 170 dock. This operation must be conducted with the dock door open and the functionality of the FEVS under that condition is unknown (*i.e.*, the level of filtration of accident scenario releases while dock doors are open is not known but an inflow of air into Room 170 is expected through the open door). OPERABILITY of the FEVS is not considered to be a concern during waste container shipping operations involving movement of the containers from a staged location in Room 170 to the transport vehicle at the dock. In addition, the shipment of waste containers from the facility is a facility risk reduction activity due to the reduction of the facility radioactive material inventory.

SR 4.2.2 is applicable to a Building 985 exhaust ventilation system filter stage as long as the Building 985 exhaust ventilation system is intended to be used. If the Building 985 exhaust ventilation system is designated as OUT OF COMMISSION and/or is rendered inoperable, SR 4.2.2 is no longer applicable to this LCO.

REQUIRED ACTION A.1

LCO 3.2 will not be met if forced exhaust ventilation is not provided as a result of a loss of off-site power to the BUILDING 991 COMPLEX. The absence of the FEVS function in the BUILDING 991 COMPLEX provides the potential for unmitigated radioactive material releases following operational accidents. The FEVS functions to mitigate radioactive material releases of many operational accidents by forcing exhaust air through a stage of HEPA filtration.

BASES

REQUIRED ACTION A.1 (continued)

Upon loss of off-site power to the BUILDING 991 COMPLEX, the Building 991 FEVS exhaust fans may stop running and the credited filtered exhaust safety function may be lost. Alternate electric power may be supplied by a diesel generator in Building 989. The diesel generator may keep the FEVS running and maintain the filtered exhaust safety function. However, a diesel generator that is not maintained and tested per requirements in TSRs is considered to have high unavailability (*i.e.*, failure to start) and unreliability (*i.e.*, failure to remain running). Therefore, the loss of off-site power is considered to be equivalent to a failure of the FEVS (*i.e.*, no power to the exhaust fans). The corresponding REQUIRED ACTION associated with a loss of the safety function is applied to the situation where the BUILDING 991 COMPLEX has lost all electric power or is operating on alternate power supplied by the diesel generator.

If the FEVS is not OPERABLE in the container storage/staging areas, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of operational accidents in the AFFECTED AREAS. The suspension of operations does not replace the filtered exhaust safety function of the FEVS but attempts to maintain an equivalent risk by reducing the likelihood of fire, spill, puncture, and hydrogen explosion scenarios. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. However, the likelihood of electrical system induced fires is considered to be significantly less than fires initiated by operations (*e.g.*, maintenance activities), particularly in the situation where facility off-site power is lost.

As discussed in the Applicability section above, movements of SNM Type B shipping containers and POCs are not suspended. Also, movements of waste containers from a staged location in Room 170 to a transport vehicle at the Room 170 dock are not suspended.

The four-hour COMPLETION TIME associated with the SUSPEND OPERATIONS REQUIRED ACTION provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work.

REQUIRED ACTION A.1 (continued)	The four-hour COMPLETION TIME does not result in undue risk due to the already continuous monitoring of the activities by the workers involved in the activities and due to the limited operations necessary to place most activities into a safe configuration. That is, most operations, other than hot work, that may be in process at the occurrence of the loss of off-site power can be terminated almost immediately, without significant additional container movements being needed. However, the REQUIRED ACTION to SUSPEND OPERATIONS in AFFECTED AREAS is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The four-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION B.1	LCO 3.2 will not be met if filtered exhaust ventilation is not provided as a result of filter loss or degradation. The absence of the filtering function of the FEVS in the BUILDING 991 COMPLEX provides the potential for unmitigated radioactive material releases following operational accidents. FEVS filtering functions to mitigate radioactive material releases of many operational accidents by forcing exhaust air through a stage of HEPA filtration. Upon loss or degradation of the filtering capability of the Building 991 FEVS, the filtered exhaust safety function may be lost. If the FEVS is not OPERABLE in the container storage/staging areas, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of operational accidents in the AFFECTED AREAS. The suspension of operations does not replace the filtered exhaust safety function of the FEVS but attempts to maintain an equivalent risk by reducing the likelihood of fire, spill, puncture, and hydrogen explosion scenarios. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. However, the likelihood of electrical system induced fires is considered to be significantly less than fires initiated by operations (*e.g.*, maintenance activities). See the discussion under REQUIRED ACTION A.1 dealing with justification of the four-hour COMPLETION TIME and the scope of the SUSPEND OPERATIONS REQUIRED ACTION.
REQUIRED ACTION C.1	LCO 3.2 will not be met if filtered exhaust ventilation is not provided as a result of filter loss or degradation. The absence of the filtering function of the FEVS in the BUILDING 991 COMPLEX provides the potential for unmitigated radioactive material releases following operational accidents. FEVS filtering functions to mitigate radioactive material releases of many operational accidents by forcing exhaust air through a stage of HEPA filtration.

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REQUIRED ACTION C.1 (continued)

The Building 985 exhaust ventilation system filtration capability is only necessary if the system is being used. The Building 985 exhaust ventilation system provides an additional exhaust path from the facility beyond that resulting from operation of the Building 991 exhaust ventilation system.

Upon loss or degradation of the filtering capability of the Building 985 FEVS, the filtered exhaust safety function may be lost. If the FEVS is not OPERABLE in the container storage/staging areas, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of operational accidents in the AFFECTED AREAS. The suspension of operations does not replace the filtered exhaust safety function of the FEVS but attempts to maintain an equivalent risk by reducing the likelihood of fire, spill, puncture, and hydrogen explosion scenarios. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. However, the likelihood of electrical system induced fires is considered to be significantly less than fires initiated by operations (*e.g.*, maintenance activities).

See the discussion under REQUIRED ACTION A.1 dealing with justification of the four-hour COMPLETION TIME and the scope of the SUSPEND OPERATIONS REQUIRED ACTION.

REQUIRED ACTION C.2

LCO 3.2 will not be met if filtered exhaust ventilation is not provided as a result of filter loss or degradation. The absence of the filtering function of the FEVS in the BUILDING 991 COMPLEX provides the potential for unmitigated radioactive material releases following operational accidents. FEVS filtering functions to mitigate radioactive material releases of many operational accidents by forcing exhaust air through a stage of HEPA filtration.

The Building 985 exhaust ventilation system filtration capability is only necessary if the system is being used. The Building 985 exhaust ventilation system provides an additional exhaust path from the facility beyond that resulting from operation of the Building 991 exhaust ventilation system.

Upon loss or degradation of the filtering capability of the Building 985 FEVS, the filtered exhaust safety function may be lost. If the FEVS is not OPERABLE in the container storage/staging areas due to a loss of filtration capability, the facility shall stop operation of the Building 985 exhaust ventilation system main exhaust fans within two hours. Termination of the fan use will negate the need for a tested stage of HEPA filtration in the Building 985 FEVS since the additional exhaust path from the facility provided by the Building 985 FEVS will not longer exist. This is an alternative REQUIRED ACTION to suspension of operations.

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BASES

REQUIRED ACTION C.2 (continued)	The two-hour COMPLETION TIME associated with stopping the Building 985 exhaust fans provides adequate time for facility management to contact the appropriate workers to perform the task. It is expected that CONDITION C will primarily be entered during the conduct of SR 4.2.2 as the filters are being tested. Most entries into CONDITION C involve situations that are expected to be repairable as part of the stage testing during the SURVEILLANCE. That is, as filters are found to be degraded or lost, new filters are installed and tested. However, the REQUIRED ACTION to stop the Building 985 fans is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The two-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION D.1	LCO 3.2 will not be met if forced exhaust ventilation is not provided as indicated by a low negative differential pressure, with respect to atmosphere, in the Building 991 FEVS exhaust plenum. The absence of the FEVS function in the container storage/staging areas of the BUILDING 991 COMPLEX provides the potential for unmitigated radioactive material releases following operational accidents. The FEVS functions to mitigate radioactive material releases of many operational accidents by forcing exhaust air through a stage of HEPA filtration. Upon loss or degradation of the FEVS in the container storage/staging areas of the BUILDING 991 COMPLEX, the filtered exhaust safety function may be lost. The loss or degradation of the ventilation capability may be a result of the failure of the running exhaust fan or an FEVS configuration change. If the FEVS is not OPERABLE in the container storage/staging areas, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of operational accidents in the AFFECTED AREAS. The suspension of operations does not replace the filtered exhaust safety function of the FEVS but attempts to maintain an equivalent risk by reducing the likelihood of fire, spill, puncture, and hydrogen explosion scenarios. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. However, the likelihood of electrical system induced fires is considered to be significantly less than fires initiated by operations (*e.g.*, maintenance activities). See the discussion under REQUIRED ACTION A.1 dealing with justification of the four-hour COMPLETION TIME and the scope of the SUSPEND OPERATIONS REQUIRED ACTION.

BASES

REQUIRED ACTION E.1

LCO 3.2 will not be met if forced exhaust ventilation is not provided as indicated by a low negative differential pressure, with respect to atmosphere, in Room 170 when the dock doors are closed. The absence of the FEVS function in Room 170 and the connected areas of Rooms 134, 135, and 147 provides the potential for unmitigated radioactive material releases following operational accidents. The FEVS functions to mitigate radioactive material releases of many operational accidents by forcing exhaust air through a stage of HEPA filtration.

Upon loss or degradation of the FEVS in Room 170, the filtered exhaust safety function may be lost. The loss or degradation of the ventilation capability may be a result of an FEVS/facility configuration change. It is anticipated that the differential pressure in Room 170 will fluctuate on windy days. The windy conditions are expected to influence the relatively low differential pressure of Room 170 yielding conditions of differential pressures near zero. If the Room 170 differential pressure remains below the threshold pressure for a period greater than 5 minutes, there is evidence that the facility configuration is not just a fluctuation but is an OUT-OF-TOLERANCE CONDITION. This would indicate that the FEVS configuration is not adequate, in some manner, or that the wind conditions are persistently impacting the differential pressure.

If the FEVS is not OPERABLE in Room 170, the facility shall SUSPEND OPERATIONS in Room 170 and the connected areas of Rooms 134, 135, and 147 within four hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of operational accidents in Rooms 134, 135, 147, and 170. The suspension of operations does not replace the filtered exhaust safety function of the FEVS but attempts to maintain an equivalent risk by reducing the likelihood of fire, spill, puncture, and hydrogen explosion scenarios. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. However, the likelihood of electrical system induced fires is considered to be significantly less than fires initiated by operations (*e.g.*, maintenance activities).

See the discussion under REQUIRED ACTION A.1 dealing with justification of the four-hour COMPLETION TIME and the scope of the SUSPEND OPERATIONS REQUIRED ACTION.

REQUIRED ACTION F.1

LCO 3.2 will not be met if filtered exhaust ventilation is not provided as a result of filter blockage as evidenced by a high differential pressure across the filter stage. The absence of the filtering function of the FEVS in the BUILDING 991 COMPLEX provides the potential for unmitigated radioactive material releases following operational accidents. FEVS filtering functions to mitigate radioactive material releases of many operational accidents by forcing exhaust air through a stage of HEPA filtration.

BASES

REQUIRED ACTION F.1 (continued)

Upon blockage of the filters in the Building 991 FEVS, the filtered exhaust safety function may be lost. If the FEVS is not OPERABLE in the container storage/staging areas, the facility shall SUSPEND OPERATIONS in the AFFECTED AREAS within four hours. The SUSPEND OPERATIONS REQUIRED ACTION is a measure to reduce the likelihood of operational accidents in the AFFECTED AREAS. The suspension of operations does not replace the filtered exhaust safety function of the FEVS but attempts to maintain an equivalent risk by reducing the likelihood of fire, spill, puncture, and hydrogen explosion scenarios. The suspension of operations does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. However, the likelihood of electrical system induced fires is considered to be significantly less than fires initiated by operations (*e.g.*, maintenance activities).

See the discussion under REQUIRED ACTION A.1 dealing with justification of the four-hour COMPLETION TIME and the scope of the SUSPEND OPERATIONS REQUIRED ACTION.

SURVEILLANCE REQUIREMENTS BASES

SR 4.2.1	The verification of the filtering efficiency of the Building 991 single stage of HEPA filtration assures, in part, the OPERABILITY of the Filtered Exhaust Ventilation System. The SR to test filter removal efficiency on an eighteen month interval is consistent with the Site HEPA filter testing interval. If SR 4.2.1 is not met, entry into LCO CONDITION B is expected.
SR 4.2.2	The verification of the filtering efficiency of a Building 985 stage of HEPA filtration assures, in part, the OPERABILITY of the Filtered Exhaust Ventilation System. This SR is only necessary if the Building 985 ventilation system is used. If the system is not used, an intentional exhaust path from the facility, other than the Building 991 Filtered Exhaust Ventilation System, that requires filtration does not exist. The SR to test filter removal efficiency on an eighteen month interval is consistent with the Site HEPA filter testing interval. If SR 4.2.2 is not met, entry into LCO CONDITION C is expected.
SR 4.2.3	The verification that the pressure differential between the inlet portion of the Building 991 ventilation system exhaust plenum and an atmosphere reference is above a specified limit assures, in part, the OPERABILITY of the Filtered Exhaust Ventilation System. The SR to verify plenum differential pressure each working shift provides an indication that a main exhaust fan is running. The working shift surveillance is sufficient, rather than a continuous surveillance, due to the type of activities conducted in the BUILDING 991 COMPLEX. Since the normal operations of the facility do not deal with exposed radioactive materials (*i.e.*, radioactive materials are in metal containers), filtered exhaust is not necessary for contamination control. The Filtered Exhaust Ventilation System provides mitigation for postulated accidents. The combination of the reliability of the system, the lack of contamination in the facility, and the likelihood of accidents resulting in radioactive material releases during a working shift justify the acceptability of a working shift versus a continuous surveillance. If SR 4.2.3 is not met, entry into LCO CONDITION D is expected.
SR 4.2.4	The verification that the pressure differential between Room 170 and an atmospheric reference does not remain below a specified limit assures, in part, the OPERABILITY of the Filtered Exhaust Ventilation System. The SR to verify Room 170 differential pressure each working shift provides an indication that the room is connected to the north waste container storage area ventilation. Also, the SR to verify Room 170 differential pressure upon completion of receipt or shipment operations provides an indication that the appropriate facility configuration to support filtered exhaust from the south waste container storage areas is restored. The differential pressure gauge measurement uncertainty is $\pm$ 0.01 in. w.g.. The Room 170 differential pressure requirement of 0.02 in. w.g. is based on the room being negative with respect to atmosphere, as evidenced by a differential pressure $\geq$ 0.01 in. w.g. negative, and instrument uncertainty of 0.01 in. w.g..

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SURVEILLANCE REQUIREMENTS BASES

SR 4.2.4 (continued)	The combination of a working shift and activity completion surveillance is sufficient, rather than a continuous surveillance due to the type of activities conducted in the BUILDING 991 COMPLEX. Since the normal operations of the facility do not deal with exposed radioactive materials (*i.e.*, radioactive materials are in metal containers), filtered exhaust is not necessary for contamination control. The Filtered Exhaust Ventilation System provides mitigation for postulated accidents. The combination of the reliability of the system, the lack of contamination in the facility, the likelihood of accidents resulting in radioactive material releases during a working shift, and the verification of configuration restoration following receiving and shipping activities justify the acceptability of a working shift versus a continuous surveillance. If SR 4.2.4 is not met, entry into LCO CONDITION E is expected.
SR 4.2.5	The verification that the pressure differential across the Building 991 ventilation system exhaust plenum is below a specified limit assures, in part, the OPERABILITY of the Filtered Exhaust Ventilation System. The SR to verify plenum differential pressure each working shift provides an indication that the plenum single stage of HEPA filtration is unblocked. The working shift surveillance is sufficient, rather than a continuous surveillance due to likelihood of events occurring that would yield blocked filters. Events of the type necessary to yield conditions that would fail the SR are significant events in the facility and their impact on the stage of HEPA filtration is likely to be investigated following the event occurrence. If SR 4.2.5 is not met, entry into LCO CONDITION F is expected.

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3./4. LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3.3 LIMITING CONDITION FOR OPERATION: BUILDING 991 COMPLEX AUTOMATIC PLENUM DELUGE SYSTEMS

LCO: The BUILDING 991 COMPLEX Automatic Plenum Deluge Systems Shall Be OPERABLE, With The Following:

1. The Building 991 exhaust ventilation system plenum shall have a deluge system composed of heat detectors, automatic deluge actuation, and manual operation capability.
2. The Building 985 exhaust ventilation system plenum shall have a deluge system composed of heat detectors, automatic deluge actuation, and manual operation capability, if the exhaust ventilation system is intended to be used.

APPLICABILITY: At all times in the Building 991 Filtered Exhaust Ventilation System plenum and in the Building 985 Filtered Exhaust Ventilation System plenum if the Building 985 ventilation system is intended to be used.

REQUIRED ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Automatic Plenum Deluge System in the Building 991 plenum not OPERABLE.	A.1 Terminate all hot work in AFFECTED AREAS.	2 hours.
	AND	
	A.2 Restore Automatic Plenum Deluge System OPERABILITY.	45 days.
B. Automatic Plenum Deluge System in the Building 985 plenum not OPERABLE.	B.1 Stop operation of the Building 985 exhaust ventilation system main exhaust fans.	2 hours.
	OR	
	B.2.1 Terminate all hot work in AFFECTED AREAS.	2 hours.
	AND	
	B.2.2 Restore Automatic Plenum Deluge System OPERABILITY.	45 days.

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REQUIRED ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. REQUIRED ACTION and COMPLETION TIME can not be met in REQUIRED ACTION(s) A.2 or B.2.2.	C.1 Submit an action plan and schedule for plenum deluge system restoration to the DOE-RFFO if the system is expected to remain OUT-OF-SERVICE for up to and including 120 days.	45 days from the time of entry into CONDITION A or B.
	OR	
	C.2 Submit a Justification for Continued Operation (JCO) for having a not OPERABLE plenum deluge system to the DOE-RFFO if the system is expected to remain or remains OUT-OF-SERVICE for more than 120 days.	45 days from the time of entry into CONDITION A or B if REQUIRED ACTION C.1 is not performed; 120 days from the time of entry into CONDITION A or B if REQUIRED ACTION C.1 is performed.

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3./4. LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

4.3 SURVEILLANCE REQUIREMENTS: BUILDING 991 COMPLEX AUTOMATIC PLENUM DELUGE SYSTEMS

SURVEILLANCE REQUIREMENT		FREQUENCY
SR 4.3.1	Verify correct positioning of plenum deluge system valves for the Building 991 Plenum Deluge System and for the Building 985 Plenum Deluge System if the corresponding ventilation system is intended to be used.	Once per month.
SR 4.3.2	Perform an overheat detector and automatic deluge valve trip test to verify that plenum overheat detectors are OPERABLE and that activation of a detector opens the deluge control valve (without water flow) for the Building 991 Plenum Deluge System and for the Building 985 Plenum Deluge System if the corresponding ventilation system is intended to be used.	Once per year.
SR 4.3.3	Perform a full operational test of the automatic deluge systems and verify that water flows through the system for the Building 991 Plenum Deluge System and for the Building 985 Plenum Deluge System if the corresponding ventilation system is intended to be used.	Once per 3 years.

3.3/4.3 BUILDING 991 COMPLEX AUTOMATIC PLENUM DELUGE SYSTEMS

BASES

BACKGROUND

The BUILDING 991 COMPLEX handles and stores low-level waste (LLW) and TRU waste containers (including pipe overpack containers (POCs)) of various types. All POC containers are packaged in robust metal containers that are not susceptible to fire damage. All of the other waste containers inside the buildings are metal drums or metal crates. Wooden LLW crates are permitted to be stored outside of the buildings in areas covered by the Automatic Sprinkler System. The BUILDING 991 COMPLEX also handles and stages Type B shipping containers holding SNM for off-site shipment. All SNM containers are packaged in robust metal containers that are not susceptible to fire damage.

The combustible loading in the interior waste container storage areas of the BUILDING 991 COMPLEX is minimal, consisting of drum-protecting plywood sheets between drum tops and metal pallets in stacked drum configurations, crate-protecting plastic covers between stacked metal crates, and limited transient combustible materials. Wooden pallets are not permitted to be used for waste container storage in the BUILDING 991 COMPLEX. Exterior waste container storage areas of the BUILDING 991 COMPLEX potentially have a higher combustible loading (*e.g.*, empty wooden crates, wooden LLW crates).

Fires impacting waste containers were evaluated in the FSAR Safety Analysis. The analysis evaluated fires initiating in the interior waste container storage areas, the exterior wooden LLW crate storage areas, and the office areas which are contiguous to waste container storage areas. The Automatic Plenum Deluge Systems provide DEFENSE-IN-DEPTH protection of the filters in the Filtered Exhaust Ventilation Systems from ignition and burning as a result of larger than analyzed facility fires that occur in ventilated areas.

The Building 991 Filtered Exhaust Ventilation System consists of a single stage of HEPA filters. A plenum deluge system inside the plenum consists of three primary subsystems: 1) an automatic deluge system located upstream of the plenum demister screen that is actuated by any of the plenum heat detectors registering 190°F; 2) a demister screen located upstream of the HEPA filter stage; and 3) a manual deluge system located after the demister screen but before the HEPA filter stage. The Building 985 Filtered Exhaust Ventilation System consists of two stages of HEPA filters and the plenum contains equivalent subsystems to the Building 991 plenum.

BASES

BACKGROUND (continued)

The automatic portion of the plenum deluge systems provides a water curtain in front of the downstream demister screen when actuated. When operating as designed, the automatic deluge system will create a water curtain that is expected to cool the air in the plenum prior to the air impacting the HEPA filter stage(s). The cooled air will then begin to lower the HEPA filter temperature to protect the filters from ignition. The automatic deluge spray may also cool hot embers and flying brands before they reach the HEPA filters, although the system was designed for air cooling rather than particulate cooling. If the automatic deluge valve fails to open, a capability exists for manual operation of the automatic deluge system by opening a manual valve in an automatic deluge valve bypass line. These bypass line manual valves are located in the basement of Building 991 for the Building 991 plenum and in Building 985 for the Building 985 plenum.

A separate manual plenum deluge system exists for each plenum. If actuated, the manual portion of the plenum deluge system provides spray directly onto the HEPA filters. The manual deluge spray and filter wetting will extinguish any filter fires that have been initiated by high temperatures, hot embers or flying brands. Additionally, the spray may cool hot embers and flying brands prior to their impact on the filters. Studies have shown that direct wetting of a stage of HEPA filtration in an active ventilation system is likely to fail the filters. The filter failure occurs due to plugging of the filter by soaked particulates (effectively stopping ventilation), by partial plugging causing media failure, or by direct spray damage. In Building 985, multiple stages of HEPA filtration exist in the plenum; therefore, the sacrifice of the first stage of filters due to wetting is more desired than the ignition of the first stage of filters with subsequent potential for fire propagation to the second stage. However, the Building 991 roof plenum only has a single stage of filters and the decision to manually actuate the deluge system requires assessing the likelihood of filter ignition if the manual spray is not actuated versus the likely failure of the stage from wetting if the manual deluge system is actuated. For the Building 991 plenum, the manual plenum deluge system actuation valve is located on the roof of Building 991, next to the plenum and a plenum window downstream of the filter stage. The manual plenum deluge system actuation valve for the Building 985 is located in Building 985.

Functional performance and maintenance expectations are established for these systems in Site procedures, which are based on accepted industry standards such as NFPA 25, *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems* (Ref. A-1), NFPA 72, *National Fire Alarm Code* (Ref. A-2); and NFPA 13, *Standard for the Installation of Sprinkler Systems* (Ref. A-3).

APPLICATION TO SAFETY ANALYSIS	The Automatic Plenum Deluge Systems support the Filtered Exhaust Ventilation Systems by providing protection of the HEPA filters during response to fires. The FEVS is a recognized control credited to mitigate the public and collocated worker radiological dose consequences for several dominant postulated accident scenarios as indicated in Chapter 5, *Safety Structures, Systems, and Components*, of the FSAR. The control was not credited as part of the accident analysis presented in the FSAR-supporting Nuclear Safety Technical Report (NSTR). Rather, the control was identified and credited as part of the dominant accident scenario discussions in the NSTR and in Chapter 4, *Hazard and Accident Analysis Summary*, of the FSAR. The single stage of HEPA filtration is credited with accident scenario mitigation for most operational event scenarios. The Automatic Plenum Deluge Systems are a DEFENSE-IN-DEPTH mitigative feature for filter protection in response to large facility fires. The internal facility fires evaluated in the safety analyses only deal with 1 MW and 2 MW fires which will not challenge the ventilation systems and filters. Larger fires would have to occur in order to reach plenum temperatures in excess of 190°F and actuate the Automatic Plenum Deluge Systems. A potential does exist for hot embers and flying brands from analyzed fires to be captured by the filters and create the potential for filter ignition, but the likelihood of this event is considered to be low. In this situation, the deluge system would only be actuated manually and only if filter ignition was observed or felt to be imminent, and the filter wetting/loss issue would influence the decision to use the system. Therefore, the likelihood of the actuation of this system, either automatically or manually, is considered to be low. As such, the system is not credited in the safety analyses and only serve as a DEFENSE-IN-DEPTH mitigative feature for a potential mitigation of low likelihood events.
LCO 3.3	The BUILDING 991 COMPLEX Automatic Plenum Deluge Systems shall be OPERABLE. For the Automatic Plenum Deluge Systems to be OPERABLE, the systems must be capable of automatically or manually supplying cooling and/or wetting water spray inside the FEVS plenums. The systems must be capable of detecting high temperatures in a ventilation system plenum and automatically opening a deluge system valve. The systems must also provide a capability of manually bypassing the automatic deluge valve and of manually actuating the filter direct spray portion of the system.

BASES

APPLICABILITY	This LCO is applicable to the Building 991 Filtered Exhaust Ventilation System plenum at all times. This LCO is also applicable to the Building 985 Filtered Exhaust Ventilation System plenum at all times if the Building 985 Filtered Exhaust Ventilation System is intended to be used. If the Building 985 FEVS is taken OUT-OF-COMMISSION or is placed in an OUT-OF-SERVICE configuration with no intention of reusing the system, the LCO is no longer applicable.
REQUIRED ACTION A.1	LCO 3.3 will not be met if the Automatic Plenum Deluge System is not OPERABLE in the Building 991 FEVS plenum. The absence of the deluge system function in the Building 991 FEVS plenum provides the potential for a large facility fire to impact the Building 991 FEVS filters. The Automatic Plenum Deluge System functions to cool the air entering the plenum and/or to suppress hot embers and flying brands from igniting the HEPA filters. Without the deluge function, the likelihood of large fires in the facility impacting the filters in the plenum is increased. The facility is still protected if the likelihood of fire initiation is decreased sufficiently to offset the increased likelihood of large fires impacting the HEPA filters. If the Automatic Plenum Deluge System is not OPERABLE, the facility shall terminate all hot work being conducted in the AFFECTED AREAS within two-hours. The termination of hot work (*i.e.*, spark/heat/flame producing work) is a measure to reduce the likelihood of fire initiation in the facility. The termination does not replace the filter protection function of the Automatic Plenum Deluge System but attempts to maintain an equivalent risk by reducing fire frequency. The termination of hot work does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. Therefore, REQUIRED ACTION A.2 is identified to expedite the restoration of the Automatic Plenum Deluge System. The two-hour COMPLETION TIME associated with the termination of hot work provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work. The termination of these activities does not negate any fire watch requirements associated with the original activity. That is, if the hot work permit stipulated a continuous fire watch for eight hours to monitor equipment while it is cooling, the termination of the activity would not relax the requirement for a continuous fire watch. The two-hour COMPLETION TIME does not result in undue risk due to the already continuous monitoring of the activities by the workers involved in the activities. However, the REQUIRED ACTION to terminate all hot work in the AFFECTED AREAS is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The two-hour COMPLETION TIME should not be used for operational convenience.

REQUIRED ACTION A.2

LCO 3.3 will not be met if the Automatic Plenum Deluge System is not OPERABLE in the Building 991 FEVS plenum. The absence of the deluge system function in the Building 991 FEVS plenum provides the potential for a large facility fire to impact the Building 991 FEVS filters. The Automatic Plenum Deluge System functions to cool the air entering the plenum and/or to suppress hot embers and flying brands from igniting the HEPA filters. Without the deluge function, the likelihood of large fires in the facility impacting the filters in the plenum is increased. The facility is still protected if the duration of the not OPERABLE configuration is decreased sufficiently to offset the increased likelihood of large fires impacting the HEPA filters.

If the Automatic Plenum Deluge System is not OPERABLE, the facility shall restore the function within 45 days. The restoration of the function within a limited time period is a measure to limit the likelihood of fire initiation in the facility impacting the HEPA filters. REQUIRED ACTION A.1 is identified to reduce the likelihood of large fire initiation during the time taken to restore the Automatic Plenum Deluge System.

The 45 day COMPLETION TIME associated with the restoration of the plenum deluge function provides adequate time for facility management to repair many of the deluge system failed configurations. Readily available spare parts can be obtained and simple repair/maintenance activities can be conducted within the 45 day period.

The 45 day COMPLETION TIME does not result in undue risk due the low likelihood of the Automatic Plenum Deluge System ever being needed or used. Fires large enough to impact the filters in the ventilation system are not considered to be credible in the safety analysis; however, the deluge system is included as a mitigative feature to provide DEFENSE-IN-DEPTH protection against the possibility of unanalyzed situations leading to a large fire. In addition, the possibility of hot ember and flying brand capture by the HEPA filters during smaller fires does exist. Therefore, the duration of time for the function being not OPERABLE should be limited and is set at 45 days due to the lower likelihood of system use, particularly given the termination of hot work as required in REQUIRED ACTION A.1. However, the REQUIRED ACTION to restore the function is expected to be achieved as soon as reasonable, even if this is significantly less than the assigned COMPLETION TIME. The 45 day COMPLETION TIME should not be used for operational convenience.

BASES

REQUIRED ACTION B.1	The Building 985 exhaust ventilation system filtration capability is only necessary if the system is being used. The Building 985 exhaust ventilation system provides an additional exhaust path from the facility beyond that resulting from operation of the Building 991 exhaust ventilation system. If the Building 985 Automatic Plenum Deluge System is not OPERABLE, the facility shall stop operation of the Building 985 exhaust ventilation system main exhaust fans within two hours. Termination of the fan use will negate the need for a system to protect the HEPA filtration in the Building 985 FEVS since the additional exhaust path from the facility provided by the Building 985 FEVS will no longer exist. Significant amounts of fire generated heat and particulates will not be drawn into a ventilation system that is not operating. This is an alternative REQUIRED ACTION to termination of hot work and restoration of the safety function. The two-hour COMPLETION TIME associated with stopping the Building 985 exhaust fans provides adequate time for facility management to contact the appropriate workers to perform the task. The REQUIRED ACTION to stop the Building 985 fans is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The two-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION B.2.1	LCO 3.3 will not be met if the Automatic Plenum Deluge System is not OPERABLE in the Building 985 FEVS plenum. The absence of the deluge system function in the Building 985 FEVS plenum provides the potential for a large facility fire to impact the Building 985 FEVS filters if the FEVS is being used. The Automatic Plenum Deluge System functions to cool the air entering the plenum and/or to suppress hot embers and flying brands from igniting the HEPA filters. Without the deluge function, the likelihood of large fires in the facility impacting the filters in the plenum is increased. The facility is still protected if the likelihood of fire initiation is decreased sufficiently to offset the increased likelihood of large fires impacting the HEPA filters. If the Automatic Plenum Deluge System is not OPERABLE, the facility shall terminate all hot work being conducted in the AFFECTED AREAS within two-hours. The termination of hot work (*i.e.*, spark/heat/flame producing work) is a measure to reduce the likelihood of fire initiation in the facility. The termination does not replace the filter protection function of the Automatic Plenum Deluge System but attempts to maintain an equivalent risk by reducing fire frequency. The termination of hot work does not preclude fire initiation. Energized electrical systems in the facility always have the potential to initiate fires. Therefore, REQUIRED ACTION B.2.2 is identified to expedite the restoration of the Automatic Plenum Deluge System.

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BASES

REQUIRED ACTION B.2.1 (continued)	The two-hour COMPLETION TIME associated with the termination of hot work provides adequate time for facility management to inform the workers of the required termination and for the workers to safely terminate the work. The termination of these activities does not negate any fire watch requirements associated with the original activity. That is, if the hot work permit stipulated a continuous fire watch for eight hours to monitor equipment while it is cooling, the termination of the activity would not relax the requirement for a continuous fire watch. The two-hour COMPLETION TIME does not result in undue risk due to the already continuous monitoring of the activities by the workers involved in the activities. However, the REQUIRED ACTION to terminate all hot work in the AFFECTED AREAS is expected to be implemented as soon as reasonably achievable, even if this is significantly less than the assigned COMPLETION TIME. The two-hour COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION B.2.2	LCO 3.3 will not be met if the Automatic Plenum Deluge System is not OPERABLE in the Building 985 FEVS plenum. The absence of the deluge system function in the Building 985 FEVS plenum provides the potential for a large facility fire to impact the Building 985 FEVS filters if the FEVS is being used. The Automatic Plenum Deluge System functions to cool the air entering the plenum and/or to suppress hot embers and flying brands from igniting the HEPA filters. Without the deluge function, the likelihood of large fires in the facility impacting the filters in the plenum is increased. The facility is still protected if the duration of the not OPERABLE configuration is decreased sufficiently to offset the increased likelihood of large fires impacting the HEPA filters. If the Automatic Plenum Deluge System is not OPERABLE, the facility shall restore the function within 45 days. The restoration of the function within a limited time period is a measure to limit the likelihood of fire initiation in the facility impacting the HEPA filters. REQUIRED ACTION B.2.1 is identified to reduce the likelihood of large fire initiation during the time taken to restore the Automatic Plenum Deluge System. The 45 day COMPLETION TIME associated with the restoration of the plenum deluge function provides adequate time for facility management to repair many of the deluge system failed configurations. Readily available spare parts can be obtained and simple repair/maintenance activities can be conducted within the 45 day period.

BASES

REQUIRED ACTION B.2.2 (continued)	The 45 day COMPLETION TIME does not result in undue risk due the low likelihood of the Automatic Plenum Deluge System ever being needed or used. Fires large enough to impact the filters in the ventilation system are not considered to be credible in the safety analysis; however, the deluge system is included as a mitigative feature to provide DEFENSE-IN-DEPTH protection against the possibility of unanalyzed situations leading to a large fire. In addition, the possibility of hot ember and flying brand capture by the HEPA filters during smaller fires does exist. Therefore, the duration of time for the function being not OPERABLE should be limited and is set at 45 days due to the lower likelihood of system use, particularly given the termination of hot work as required in REQUIRED ACTION B.2.1. However, the REQUIRED ACTION to restore the function is expected to be achieved as soon as reasonable, even if this is significantly less than the assigned COMPLETION TIME. The 45 day COMPLETION TIME should not be used for operational convenience.
REQUIRED ACTION C.1	LCO 3.3 will not be met if the Automatic Plenum Deluge System is not OPERABLE in either the Building 991 FEVS plenum or the Building 985 FEVS plenum, if the ventilation system is being used. The absence of the deluge system function in either FEVS plenum provides the potential for a large facility fire to impact the corresponding FEVS filters. The Automatic Plenum Deluge System functions to cool the air entering the plenum and/or to suppress hot embers and flying brands from igniting the HEPA filters. Without the deluge function, the likelihood of large fires in the facility impacting the filters in the plenum is increased. The facility is still protected if the duration of the not OPERABLE configuration is decreased sufficiently to offset the increased likelihood of large fires impacting the HEPA filters. If the Automatic Plenum Deluge System is expected to be or is not OPERABLE for more than 45 days but less than 121 days, the facility shall submit an action plan and schedule for system restoration to the DOE/RFFO within 45 days of the entry into CONDITION A or B. If the system is expected to be not OPERABLE for more than 120 days, REQUIRED ACTION C.2 should be performed. The action plan shall: (1) characterize the deficiency; (2) state the effect of the deficiency on the FSAR required safety function; (3) address the collective significance of the deficiency with other existing facility conditions (*e.g.*, current JCOs, discovery issues, other equipment with degraded safety functions); (4) define actions that have been taken to ensure and maintain a safe facility configuration; (5) provide the repair strategy and schedule in sufficient detail to establish critical path milestones (*e.g.*, receipt of replacement parts, vendor availability).

REQUIRED ACTION C.2

LCO 3.3 will not be met if the Automatic Plenum Deluge System is not OPERABLE in either the Building 991 FEVS plenum or the Building 985 FEVS plenum, if that ventilation system is being used. The absence of the deluge system function in the either FEVS plenum provides the potential for a large facility fire to impact the corresponding FEVS filters. The Automatic Plenum Deluge System functions to cool the air entering the plenum and/or to suppress hot embers and flying brands from igniting the HEPA filters. Without the deluge function, the likelihood of large fires in the facility impacting the filters in the plenum is increased. The facility is still protected if the duration of the not OPERABLE configuration is decreased sufficiently to offset the increased likelihood of large fires impacting the HEPA filters.

In the event that either of the Automatic Plenum Deluge Systems are not OPERABLE for an extended time period, a justification of why the facility may continue to operate in that configuration shall be developed. The time at which concern exists over the duration of the not OPERABLE system has been set at 120 days. The form of the justification for operations beyond the 120 days is a JCO.

If the Automatic Plenum Deluge System is expected to be or is not OPERABLE for more than 120 days, the facility shall submit a JCO to the DOE/RFFO within 120 days of the entry into CONDITION A or B. The JCO can be submitted within 45 days of entering CONDITION A or B in lieu of performing REQUIRED ACTION C.1 if it is known that the not OPERABLE configuration will exist for more than 120 days.

SURVEILLANCE REQUIREMENTS BASES

SR 4.3.1

The verification of the correct positioning of plenum deluge system valves in the Building 991 Deluge System and in the Building 985 Plenum Deluge System if the corresponding ventilation system is intended to be used assures, in part, the OPERABILITY of the Automatic Plenum Deluge Systems. The SR to verify valve positioning on a monthly interval satisfies several of the requirements found in NFPA 25. If SR 4.3.1 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on which system is deficient.

SR 4.3.2

The performance of an overheat detector and automatic deluge value test of the Building 991 Deluge System and of the Building 985 Plenum Deluge System if the corresponding ventilation system is intended to be used assures, in part, the OPERABILITY of the Automatic Plenum Deluge Systems. The SR to test the systems annually satisfies, in part, requirements found in NFPA 25 and NFPA 72. If SR 4.3.2 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on which system is deficient.

As stated in the BASES of LCO 3.3, the Automatic Plenum Deluge Systems are DEFENSE-IN-DEPTH systems and are not credited controls in the safety analysis. Arguments have been made that the size fire needed to yield exhaust ventilation system air temperatures in excess of 190°F (the heat detector setpoint for the actuation of the automatic portion of the deluge systems) is not considered to be credible. However, the system is to be maintained in its current configuration (*i.e.*, not allowed to degrade any further than its currently realized) as added assurance for protection of the HEPA filters against the impacts of larger fires than those analyzed in the safety analysis. Full compliance with NFPA requirements is not expected or necessary because of the low likelihood of system actuation and need.

The testability of the heat detectors of the Building 991 Automatic Plenum Deluge System has degraded since initial installation. The three plenum intake ducts each have three heat detectors equally spaced around the duct. The testing apparatus for some of the nine heat detectors (at writing, five of the nine) is no longer available due to cable exposures to the elements over the years. At least one heat detector in each intake duct is testable. The adequacy of this configuration for a credited safety system would be questionable since a single heat detector in the intake duct may not be able to detect all situations of high intake duct air temperatures (*i.e.*, the heated air may "hug" a wall of the duct rather than mix yielding lower air temperature readings by a heat detector outside of the heated air stream). A credited safety system would require full testing of the system, including all heat detectors in the system.

SURVEILLANCE REQUIREMENTS BASES

SR 4.3.2 (continued)

Due to the expectation that the automatic portion of the system will never be needed or actuated (regardless of the heated air orientation in the duct) based on credible fire scenarios, manual actuation of the Building 991 plenum deluge system is the primary means of system actuation. For large fires, the fire suppression system in the facility will actuate and provide signals to the Fire Dispatch Center instigating Fire Department response. The Fire Department manual actuation of the deluge system would be based on visual observations of plenum conditions and filter stage behavior which do not require temperature indication.

If the fire suppression system flow alarm does not actuate due to lack of suppression system response or alarm failure, the Fire Department would not necessarily know about the fire and manual actuation of the deluge system would not occur. However, it is expected that the deluge system would also fail to operate if the fire suppression system actually failed, even if automatically actuated (*i.e.*, dominant failure mode of fire suppression system and flow alarm is loss of water supply which would also impact the deluge system). Loss of the flow alarm but operation of the fire suppression system will further reduce the likelihood of large fires capable of impacting the plenum, eliminating the need for the deluge system.

In summary, from the standpoint of the TSRs and this deluge system SR, the existing configuration of the Automatic Plenum Deluge Systems is expected to be maintained, even though full compliance with NFPA requirements may not be met. Current degradation of the deluge systems preventing full testing of the system heat detectors is acceptable and does not result in a failure to meet this SR.

SR 4.3.3

The performance of a spray nozzle flow test of the Building 991 Deluge System and of the Building 985 Plenum Deluge System if the corresponding ventilation system is intended to be used assures, in part, the OPERABILITY of the Automatic Plenum Deluge Systems. The SR to test the flow once every three years satisfies, in part, requirements found in NFPA 25. If SR 4.3.3 is not met, entry into LCO CONDITION A or LCO CONDITION B is expected, depending on which system is deficient.

As stated in the BASES of LCO 3.3, the Automatic Plenum Deluge Systems are DEFENSE-IN-DEPTH systems and are not credited controls in the safety analysis. Arguments have been made that the size fire needed to yield exhaust ventilation system air temperatures in excess of 190°F (the heat detector setpoint for the actuation of the automatic portion of the deluge systems) is not considered to be credible. However, the system is to be maintained in its current configuration (*i.e.*, not allowed to degrade any further than its currently realized) as added assurance for protection of the HEPA filters against the impacts of larger fires than those analyzed in the safety analysis. Full compliance with NFPA requirements is not expected or necessary because of the low likelihood of system actuation and need.

SURVEILLANCE REQUIREMENTS BASES

SR 4.3.3
(continued)

The capability to observe spray patterns of the automatic portion of the deluge system in the Building 991 is significantly impaired due to the close proximity of the filter stage to the plenum wall. That is, the inlet plenum wall is very close to the filter stage blocking view of some of the spray nozzles due to limitations of line of sight. Also, nozzle sprays near observation ports degrade the visibility of the spray for nozzles further away from the observation port. The adequacy of this configuration for a credited safety system would be questionable since nozzle spray patterns for some portions of the plenum may not mitigate high air temperature or hot ember and flying brand impacts on filters (*i.e.*, certain areas of the filter stage may not be cooled or protected against hot particulates). A credited safety system would require full observation of the system spray nozzle patterns over the entire plenum.

Due to the expectation that the automatic portion of the system will never be needed or actuated based on credible fire scenarios, manual actuation of the Building 991 plenum deluge system is the primary means of system actuation. The Fire Department manual actuation of the deluge system would be based on visual observations of filter stage behavior at the roof observation port. The manual deluge portion of the system (sprays downstream of the demister and directly onto the filter stage) is the only part of the system capable of being actuated from the roof. If it is decided to use the manual deluge portion of the system, the spray patterns of the automatic deluge system nozzles are not relevant since they are not used in that situation. The testing of the manual deluge spray is not appropriate due to the damage caused by wetting the filters.

In summary, from the standpoint of the TSRs and this deluge system SR, the existing configuration of the Automatic Plenum Deluge Systems is expected to be maintained, even though full compliance with NFPA requirements may not be met. Current inability to observe the entire spray patterns of the automatic portion of the deluge system is acceptable and does not result in a failure to meet this SR.

5 ADMINISTRATIVE CONTROLS

5.0 GENERAL APPLICATION

AC 5.0, General Application, only applies to individual failures against CREDITED PROGRAMMATIC ELEMENTS in AC 5.1 through AC 5.5 and does not apply to other aspects of SMPs. All other Safety Management Programs are evaluated through self-assessments conducted in accordance with the Site Integrated Oversight Manual and tracked, trended, and corrected in accordance with the requirements of the specific Safety Management Program (i.e., Radiological Improvement Reports, Criticality Safety Infractions, or Occurrence Reports).

5.0.1 ACs Shall Be Met At All Times

Administrative Controls (ACs) shall be met at all times, unless otherwise specified.

AC deviations may occur at three levels: individual failures, programmatic deficiencies, and AC VIOLATIONS.

5.0.2 AC Individual Failure

Individual failures to comply with a CREDITED PROGRAMMATIC ELEMENT of an AC, which are isolated and not systemic in nature, do not constitute non-compliance with the AC. Individual failures, deemed to be systemic in nature, are addressed under AC 5.0.3, AC Programmatic Deficiency.

An individual failure of an AC limit and its action statement is an AC VIOLATION.

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5.0.3 AC Programmatic Deficiency

The CREDITED PROGRAMMATIC ELEMENTS in each AC are the standards by which the adequacy of the AC is assessed. The programmatic ACs may be implemented by specific Site Integrated SMP elements or through a building-specific program.

An AC programmatic deficiency occurs when:

a. Facility management can not demonstrate that an adequate administrative and physical infrastructure exists to implement each programmatic AC;
b. Facility management can not demonstrate that the infrastructure has been reasonably implemented to meet the programmatic ACs; or
c. Facility management can not demonstrate that appropriate measures have been taken to address recurring individual failures to meet the programmatic ACs.

An AC programmatic deficiency shall require the following actions:

a. Notify DOE-RFFO of the programmatic deficiency in accordance with Occurrence Reporting requirements;
b. Conduct a root cause analysis to identify the corrective actions to ensure future compliance with the AC requirement and prevent recurrence;
c. Inform DOE-RFFO of root cause analysis and corrective actions in accordance with Occurrence Reporting requirements; and
d. Implement corrective actions.

5.0.4 AC VIOLATION

An AC VIOLATION occurs when:

a. Planned corrective actions for a programmatic deficiency are not fully implemented;
b. The same programmatic deficiency occurs within one year of the initial-systemic safety concern;
c. An AC limit and its action statement are not met; or
d. Failure to perform an AC specified SURVEILLANCE REQUIREMENT within the required frequency.

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5.0.4 (cont) Upon identification that an AC VIOLATION exists, the following actions are required:

a. Ensure a safe facility configuration for violations associated with specific controls or restrictions (i.e., suspension of operations in the affected areas); and
b. Notify DOE-RFFO of the VIOLATION in accordance with occurrence reporting requirements.

5.0.5 AC 5.0.5 establishes an exception to mandatory compliance with requirements in the ADMINISTRATIVE CONTROLS when designated SSCs or areas have been OUT OF COMMISSION in accordance with the conditions specified in the TSR definition section. OUT OF COMMISSION SSCs or areas may be considered to be administratively removed from the BUILDING 991 COMPLEX and no longer subject to the TSR requirements.

5.1 ORGANIZATION AND MANAGEMENT

5.1.1 Requirement for Organization and Management

A minimum staff shall be in place to ensure operation within the controls defined in the TSRs. Lines of authority, responsibility, and communication shall be established and defined down through the Facility Manager, including safety and operating organizations important to ensure safe operation.

5.1.2 CREDITED PROGRAMMATIC ELEMENTS

The program shall include the following CREDITED PROGRAMMATIC ELEMENTS:

a. The lines of authority, responsibility, and communication are documented and updated, as appropriate, in the form of organizational charts, functional descriptions of departmental responsibilities and relationships, and job descriptions of key personnel positions, or in equivalent forms of documentation; and

b. The minimum staff is the number of qualified personnel (e.g., managers/supervisors and operators), necessary for facility safety. The minimum staffing level is maintained as follows to ensure the facility is operated within the analyzed safety envelope:

5.1.3 Specific Controls or Restrictions

The BUILDING 991 COMPLEX shall have a process to assure adequate staffing during the performance of Special Nuclear Material (SNM) and waste handling activities, during storage/facility maintenance operations that could effect the safety envelope, and during non-working hours. Adequate staffing includes having:

1. RCT support shall be provided as required by the Radiological Work Permit whenever BUILDING 991 COMPLEX SNM or waste handling activities occur or whenever storage/facility maintenance operations requiring a RCT are performed;

2. The Facility Manager or designee shall be on duty whenever SNM or waste handling activities occur or whenever storage/facility maintenance operations that could effect the safety envelope are performed;

3. The Facility Manager or designee shall be on call during non-working hours; and

4. Criticality Safety personnel shall be on call at all times for response to and assessment of incidents or discovered conditions involving fissile material.

The Fire Department shall be available to respond to fires in the Building 991 Complex

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APPLICABILITY: Adequate staffing for the BUILDING 991 COMPLEX is applicable at all times as stated above.

ACTIONS:

CONDITION	**REQUIRED ACTION**	**COMPLETION TIME**
1. The minimum designated staffing is not maintained.	1. Restore staffing to minimum requirements.	4 hours
	OR	
	2.1 Make appropriate notifications within the facility and the Site Shift Superintendent.	4 hours
	AND	
	2.2 Terminate affected operations.	4 hours
2. Notification that the Fire Department does not have minimum staffing required to respond to a fire in the BUILDING 991 COMPLEX.	1. Terminate all hot work in the BUILDING 991 COMPLEX.	4 hours
	AND	
	2. SUSPEND OPERATIONS in all AFFECTED AREAS.	4 hours

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5.2 INVENTORY CONTROL AND MATERIAL MANAGEMENT

5.2.1 Requirement for Inventory Control and Material Management

A program shall be established, implemented and maintained to protect NUCLEAR MATERIAL and radioactive material, and to control storage configurations, locations and quantities in accordance with the limits analyzed in the hazard/accident analysis.

5.2.2 CREDITED PROGRAMMATIC ELEMENTS

The program shall include the following CREDITED PROGRAMMATIC ELEMENTS:

a. Configuration, location, and quantities of NUCLEAR MATERIAL (excluding holdup) are controlled (e.g., quantity per container, storage location, stack height);

b. NUCLEAR MATERIAL (including fissile solutions if applicable) is packaged and stored in Site approved containers;

c. Inspections are performed to detect degradation of NUCLEAR MATERIAL containers; and

d. Containers (*e.g.*, drums, piping, bottles and tanks) that require venting and purging are identified, and venting and purging (if required) are performed where hydrogen generation is possible.

5.2.3 Specific Controls or Restrictions

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AOL 1 POC and waste containers received at and stored in the BUILDING 991 COMPLEX shall meet on-site transportation requirements. Wooden LLW crates received at and stored in the BUILDING 991 COMPLEX shall contain plastic liners per Site procedures.

POC and waste container integrity is a part of meeting the specifications. All POC and waste containers received at the BUILDING 991 COMPLEX docks shall be verified to be compliant with this requirement either ***before shipment*** to the BUILDING 991 COMPLEX or ***at receipt***.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. POC or waste container does not meet on-site transportation requirements or wooden LLW crate does not contain a plastic liner when received.	1. Segregate the non-compliant POC, waste container, or wooden LLW crate.	1 hour.
	AND 2. Develop and begin implementation of an action plan defining necessary short-term compensatory measures and final disposition of the non-compliant POC, waste container, or wooden LLW crate.	24 hours.
	AND 3. Bring the non-compliant POC, waste container, or wooden LLW crate into compliance or remove from the BUILDING 991 COMPLEX.	1 week.
2. Discovery that POC or waste container does not meet on-site transportation requirements or wooden LLW crates does not contain a plastic liner while in storage in the BUILDING 991 COMPLEX.	1. Segregate the non-compliant POC, waste container, or wooden LLW crate.	8 hours.
	AND 2. Develop and begin implementation of an action plan defining necessary short-term compensatory measures and final disposition of the non-compliant POC, waste container, or wooden LLW crate.	24 hours.
	AND 3. Bring the non-compliant POC, waste container, or wooden LLW crate into compliance or remove from the BUILDING 991 COMPLEX.	1 week.

AOL 2 **SNM containers staged in the BUILDING 991 COMPLEX shall meet Type B shipping container certification. SNM containers shall only be staged in vaults in the BUILDING 991 COMPLEX.**

All SNM containers received at the BUILDING 991 COMPLEX docks shall be verified to be compliant with this requirement either ***before shipment*** to the BUILDING 991 COMPLEX or ***at receipt***.

APPLICABILITY: At all times in the Building 991 west dock and the vault areas of the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. SNM container does not meet Type B shipping container certification requirements when received.	1. Remove the non-compliant SNM container from the BUILDING 991 COMPLEX.	4 hours.
2. Discovery that SNM container is not stored inside a vault in the BUILDING 991 COMPLEX.	1. Notify facility management of a SNM container(s) outside a vault. **<u>AND</u>** 2. Move the non-compliant staged SNM container into a vault or remove from the BUILDING 991 COMPLEX.	1 hour. 1 week.

AOL 3 Metal waste containers received at and stored in the BUILDING 991 COMPLEX shall be vented.

All metal waste containers received at the BUILDING 991 COMPLEX docks shall be verified to be compliant with this requirement either ***before shipment*** to the BUILDING 991 COMPLEX or ***at receipt***.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. Metal waste container is not vented when received.	1. Segregate the unvented metal waste container. **AND** 2. Remove the unvented metal waste container from the BUILDING 991 COMPLEX.	1 hour. 24 hours.
2. Discovery that metal waste container is not vented while in waste container storage area in the BUILDING 991 COMPLEX.	1. Segregate the unvented metal waste container. **AND** 2. Remove the unvented metal waste container from the BUILDING 991 COMPLEX.	8 hours. 72 hours.

AOL 4 **The quantities of radioactive material in LLW drums and LLW crates received at and stored in the BUILDING 991 COMPLEX shall not exceed 0.5 grams Weapons Grade Plutonium equivalent and 3 grams Weapons Grade Plutonium equivalent, respectively.**

The quantities of radioactive material in TRU waste drums and TRU waste crates received at and stored in the BUILDING 991 COMPLEX shall not exceed 200 grams Weapons Grade Plutonium equivalent and 320 grams Weapons Grade Plutonium equivalent, respectively.

The quantities of radioactive material in POC containers received at and stored in the BUILDING 991 COMPLEX shall not exceed either 1,255 grams Weapons Grade Plutonium equivalent or 200 grams (or Criticality Safety approved amount) fissionable material.

All POC and waste containers received at the BUILDING 991 COMPLEX docks shall be verified to be compliant with this requirement either ***before shipment*** to the BUILDING 991 COMPLEX or ***at receipt***.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	**REQUIRED ACTION**	**COMPLETION TIME**
1. Waste container does not meet inventory requirement when received.	1. Terminate all container movements in the vicinity of the non-compliant container.	10 minutes.
	<u>**AND**</u> 2. Contact Criticality Safety to determine if the container is infracted if greater than 200 grams fissionable material.	2 hours.
	<u>**AND**</u> 3. Remove the non-compliant container from the BUILDING 991 COMPLEX.	If the container is not infracted, <u>within 24 hours</u>. <u>**OR**</u> If the container is infracted, per direction of Criticality Safety.

CONDITION	REQUIRED ACTION	COMPLETION TIME
2. Discovery that waste container does not meet inventory requirement while in storage in the BUILDING 991 COMPLEX.	1. Terminate all container movements in the vicinity of the non-compliant container.	10 minutes.
	AND 2. Contact Criticality Safety to determine if the container is infracted if greater than 200 grams fissionable material.	2 hours.
	AND 3. Remove the non-compliant container from the BUILDING 991 COMPLEX.	If the container is not infracted, within 72 hours following identification of a receiving facility. **OR** If the container is infracted, per direction of Criticality Safety.

AOL 4 EXCEPTION

The BUILDING 991 COMPLEX is assumed to initially contain one 55-gallon waste drum with a quantity of americium that is higher than that expected from the decay of ^{241}Pu in Weapons Grade Plutonium (WG Pu). This waste drum, identification number 84291, contains 208 grams WG Pu equivalent. It is assumed that no other waste drums containing more than 200 grams WG Pu equivalent are introduced into the BUILDING 991 COMPLEX prior to implementation of these TSRs. Removal of this drum from the facility is not required.

AOL 5 Wooden LLW crates stored at the BUILDING 991 COMPLEX shall be located outside of buildings, shall be located in areas covered by the Automatic Sprinkler System, and shall be located in compliance with Fire Protection Program requirements. No more than fifty (50) wooden LLW crates may be stored at the BUILDING 991 COMPLEX.

The number of wooden LLW crates in the BUILDING 991 COMPLEX shall be verified to be compliant with this requirement *once per week*.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. Discovery that wooden LLW crate is located in an unapproved area of the BUILDING 991 COMPLEX.	1. Relocate the misplaced wooden LLW crate to a compliant location in the BUILDING 991 COMPLEX.	8 hours.
2. Discovery that the wooden LLW crate inventory limit requirement has been exceeded in the BUILDING 991 COMPLEX following the weekly inspection.	1. Remove the excess wooden LLW crates from the BUILDING 991 COMPLEX.	72 hours.

AOL 5 EXCEPTIONS

The BUILDING 991 COMPLEX is permitted to have two (2) wooden LLW crates generated by the drum crushing activity in Building 984.

The BUILDING 991 COMPLEX is permitted to have one (1) wooden LLW crate in Building 985.

Empty wooden crates do not contribute to the total number of wooden LLW crates (50) that may be stored at the BUILDING 991 COMPLEX.

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AOL 6 SNM, POC, and waste containers received at, stored in, and staged in the BUILDING 991 COMPLEX shall be compliant with all requirements specified in the Criticality Safety Evaluation for the Complex.

All SNM, POC, and waste containers received at the BUILDING 991 COMPLEX docks shall be verified to be compliant with this requirement either ***before shipment*** to the BUILDING 991 COMPLEX or ***at receipt***. The location and arrangement of the POC and waste containers in the BUILDING 991 COMPLEX shall be verified to be compliant with this requirement ***based on the periodicity specified by the Criticality Safety Program***.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. SNM, POC, or waste container does not meet the Criticality Safety Evaluation requirements when received.	1. Terminate all container movements in the vicinity of the non-compliant container. **AND** 2. Contact Criticality Safety. **AND** 3. Remove the non-compliant container from the BUILDING 991 COMPLEX.	10 minutes. 2 hours. Per direction of Criticality Safety.
2. Discovery that stored SNM, POC, or waste container does not meet Criticality Safety Evaluation requirement following periodic verification.	1. Terminate all container movements in the vicinity of the non-compliant container(s). **AND** 2. Contact Criticality Safety. **AND** 3. Remove the non-compliant container from the BUILDING 991 COMPLEX or rearrange the container configuration in the BUILDING 991 COMPLEX.	10 minutes. 2 hours. Per direction of Criticality Safety.

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AOL 7 All pallets of waste containers that are stacked to a third or fourth tier shall be banded.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. Discovery that waste containers stacked on the third or fourth tier and not banded.	1. Remove the non-banded pallet of containers from the third or fourth tier.	8 hours.
	OR	
	2. Band the pallet of containers and replace in the third or fourth tier, if necessary.	8 hours.

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AOL 8 **An operations control program shall be implemented in the BUILDING 991 COMPLEX. Attributes for the operations program include:**

- **Restrictions on the conduct of activities including:**

  Operations, other than container receipt, container shipment, movement of SNM Type B shipping containers, and movement of POCs, shall not be conducted inside Rooms 147 and 170 when a Room 170 dock door is opened; and

  To conduct operations in Rooms 134 and 135, other than movement of POCs, there must be an airflow connection between Room 134 and the north waste storage area.

- **Restrictions on container stacking including:**

  Type B shipping containers shall not be stacked in staging area; and

  Waste containers being received or staged for shipping shall not be stacked more than 2-high in Room 170.

- **Restrictions on container storage location including:**

  Waste containers shall not be stored in Corridor C;

  Only POCs shall be stored in Room 166;

  Storage of waste containers is prohibited in Building 985; and

  Waste generated in Building 985 shall be removed from Building 985 within 24 hours of job completion.

- **Restrictions on container contents and use including:**

  Type B shipping containers, POC containers, and TRU waste containers shall not be opened in the BUILDING 991 COMPLEX;

  Waste containers shall not contain liquids that can lead to significant hydrogen generation and/or metal waste container vent plugging; and

  Pyrophoric material waste containers are prohibited from the BUILDING 991 COMPLEX.

All waste containers received by the BUILDING 991 COMPLEX shall be verified to be compliant with the liquid content requirement either ***before shipment*** to the BUILDING 991 COMPLEX or ***at receipt***.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

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ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. Operations restrictions not met in the BUILDING 991 COMPLEX.	1. If Room 170 dock door opened during conduct of operations in Rooms 147 and 170 that are restricted when the dock door is open, close dock door.	15 minutes.
	OR	
	2. If operations in Rooms 147 and 170 that are restricted when the dock door is open are conducted in Rooms 147 and 170 while Room 170 dock door is opened, close the dock door.	15 minutes.
	OR	
	3. If proper airflow connection to the north waste storage area from the south waste storage areas is lost, other than during container receipt and shipment in Room 170, restore connection.	15 minutes.
2. Operations requirement not met while container at the BUILDING 991 COMPLEX docks.	1. If container with liquid or pyrophoric material, segregate the non-compliant container.	1 hour.
	AND	
	2. Develop and begin implementation of an action plan defining necessary short-term compensatory measures for the non-compliant container.	24 hours.
	AND	
	3. Remove the non-compliant container from the BUILDING 991 COMPLEX.	1 week.

CONDITION	REQUIRED ACTION		COMPLETION TIME
3. Discovery that operations requirement not met while waste container is in storage in the BUILDING 991 COMPLEX.	1.	If restricted containers are stacked higher than permitted or restricted area has stacking, remove non-compliant stacked containers from stacks.	8 hours.
	OR 2.	If containers are stored in a restricted area, remove non-compliant container from restricted area.	8 hours.
	OR 3.1	If container is open (other than by accident), develop and begin implementation of an action plan defining necessary short-term compensatory measures for open container. **AND**	8 hours.
	3.2	Close and seal the opened container.	1 day.
	OR 4.1	If container with liquid or pyrophoric material, segregate the non-compliant container. **AND**	8 hours.
	4.2	Develop and begin implementation of an action plan defining necessary short-term compensatory measures for the non-compliant container. **AND**	24 hours.
	4.3	Remove the non-compliant container from the BUILDING 991 COMPLEX.	1 week.
	OR 5.	If waste generated in Building 985 is not removed from the building within 24 hours of job completion, remove the waste.	8 hours

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5.3 CONTROL OF COMBUSTIBLE MATERIALS AND IGNITION SOURCES

5.3.1 Requirements for Control of Combustible Materials and Ignition Sources

A program shall be established, implemented, and maintained to control and verify combustible materials and ignition sources to ensure compliance with the limits analyzed in the hazard/accident analysis.

APPLICABILITY: This control applies to solid combustible material not stored in metal containers, and combustible/flammable liquids not stored in an approved manner.

5.3.2 CREDITED PROGRAMMATIC ELEMENTS

The program shall include the following CREDITED PROGRAMMATIC ELEMENTS:

a. Combustible package spacing is maintained;

b. Spark, heat, or flame-producing work is controlled;

c. Combustible package size is controlled; and

d. Applicable corrective actions resulting from periodic Fire Protection inspection findings are implemented commensurate with their safety significance.

5.3.3 Specific Controls or Restrictions

The program shall have the combustible and ignition source control limits noted in the following AOLs.

AOL 9 **A combustible material and ignition source control program shall be implemented in the BUILDING 991 COMPLEX. Attributes for the combustible material and ignition source program include:**

- **Restrictions on high heat release rate combustible materials including:**

  Flammable/combustible liquids shall not be stored outside NFPA approved cabinets;

  Quantities of flammable/combustible liquids in excess of 2 gallons shall not be located in waste container storage areas without proper containment/confinement (*e.g.*, dike, secondary container);

  Quantities of plastic material which would yield more than 2 gallons of material when melted shall not be located in waste container storage areas without proper containment/confinement; and

  Fossil-fueled material handling vehicles shall not be used in interior waste container storage areas.

- **Restrictions on combustible loading including:**

  Wooden pallets shall not be used for waste container storage;

  No wooden crates shall be permitted in interior waste container storage areas; and

  Combustible loading shall be maintained consistent with Fire Hazards Analysis categorization (Ref. 4) (*i.e.*, very limited combustibles in waste container storage areas).

- **Restrictions on combustible material location including:**

  Combustible materials shall remain separated from waste containers by at least five feet; and

  Flammable gas containers shall not be stored in the BUILDING 991 COMPLEX.

- **Restrictions on ignition sources including:**

  Smoking shall not be permitted inside facilities containing waste container storage areas; and

  Hot work shall be controlled by a permitting process.

The combustible material and ignition source control program in the BUILDING 991 COMPLEX shall be verified to be compliant with this requirement ***once per month***

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

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ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. High heat release rate combustible material requirements not met while waste containers in storage in BUILDING 991 COMPLEX.	1.1 If excess flammable/combustible liquids or plastic, remove excess flammable/combustible liquid or plastic material from waste container storage area. **OR** 1.2 Meet requirements dealing with flammable/combustible liquids or plastic material in waste container storage area. **OR** 2.1 If flammable/combustible liquids stored outside cabinets, remove improperly stored flammable/combustible liquid from applicable areas (see BASES). **OR** 2.2 Store flammable/combustible liquid in NFPA approved cabinet. **OR** 3. If fossil-fueled vehicle in storage area, remove fossil-fueled vehicle from interior waste container storage area.	24 hours. 24 hours. 4 hours. 4 hours. 1 hour.
2. Combustible loading requirement not met while waste containers in storage in the BUILDING 991 COMPLEX.	1. If wooden crate, remove wooden crate from interior waste container storage area. **OR** 2. If wooden pallet(s) used in storage, remove wooden pallet(s) from waste container storage application. **OR** 3. If combustible loading increased over FHA categorization, reduce transient combustible loading in waste container storage area.	24 hours. 4 hours. Per direction of Fire Protection.
3. Combustible material location requirement not met while waste containers in storage in the BUILDING 991 COMPLEX.	1.1 If combustibles within 5 feet of containers, separate combustible material from waste containers. **OR** 1.2 Remove combustible material from waste container storage area. **OR** 2. If flammable gas container stored in complex, remove flammable gas container from applicable areas (see BASES).	4 hours. 4 hours. 1 hour.

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CONDITION	REQUIRED ACTION	COMPLETION TIME
4. Ignition source control requirements not met while waste containers in storage in the BUILDING 991 COMPLEX.	1.1 If un-permitted hot work, terminate un-permitted hot work in applicable areas (see BASES). **AND**	1 hour.
	1.2 Meet any Fire Protection requirements dealing with hot work termination.	Per direction of Fire Protection.
	OR 2. If smoking in applicable areas (see BASES), extinguish smoking material.	Immediately.

AOL 10 A flammable gas use control program shall be implemented in the BUILDING 991 COMPLEX. Attributes for the flammable gas program include:

- **Restrictions on flammable gas containers including:**

  Flammable gas containers shall meet DOT requirements; and

  Flammable gas container (fully charged) contents shall not exceed a maximum gas volume of 150 cubic feet.

- **Restrictions on flammable gas container location and use including:**

  Flammable gas containers shall not be placed within five feet of radioactive material containers;

  Flammable gas containers shall not be taken into waste container storage area Room 135, Room 142, Room 143, Room 147, Room 148, Room 158, and Building 996; and

  Flammable gas shall not be used in vaults while SNM is present.

The flammable gas use control program in the BUILDING 991 COMPLEX shall be verified to be compliant with this requirement ***once per month***.

APPLICABILITY: At all times in the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. Flammable gas container requirements not met while waste containers in storage in the BUILDING 991 COMPLEX.	1. If flammable gas container is non-compliant with DOT requirements, remove non-compliant flammable gas container from applicable areas (see BASES).	1 hour.
	OR	
	2. If flammable gas container exceeds volume limits, remove non-compliant flammable gas container from applicable areas (see BASES).	1 hour.

CONDITION	REQUIRED ACTION		COMPLETION TIME
2. Flammable gas location and use requirements not met while waste containers in storage in the BUILDING 991 COMPLEX.	1.1	If flammable gas container within 5 feet of containers, separate flammable gas from waste containers.	10 minutes.
		OR	
	1.2	Remove flammable gas container from waste container storage area.	1 hour.
	OR		
	2.	If flammable gas container in prohibited area, remove flammable gas container from prohibited area.	1 hour.

AOL 10 EXCEPTION

Flammable gas containers may be within five (5) feet of radioactive waste containers if appropriate controls, as specified in the hot work permit, have been implemented (e.g., fire blankets covering waste containers within the five (5) foot distance).

5.4 MAINTENANCE AND SURVEILLANCE OF SC-3 SSCS

5.4.1 Requirements for Maintenance and Surveillance of SC-3 SSCs

A program shall be developed, implemented and maintained to provide the required safety functions of SC-3 SSCs.

APPLICABILITY: This control applies to the SSCs in Table 2 which are the SC-3 SSCs identified in the safety analyses for DEFENSE-IN-DEPTH and worker safety, and the SC-3 SSCs required to support SC-1/2 SSCs.

5.4.2 CREDITED PROGRAMMATIC ELEMENTS

The program shall include the following CREDITED PROGRAMMATIC ELEMENTS:

a. Safety functions provided by SC-3 SSCs are maintained as stated in Table 2;

b. The functionality of in-service SC-3 SSCs is periodically verified;

c. SC-3 SSCs are inspected and/or acceptance tested following repair;

d. Changes made to SC-3 SSCs, and associated engineering documentation and operating instructions, are controlled; and

e. Applicable corrective actions resulting from periodic inspection findings (e.g., Fire Protection) are implemented commensurate with their safety significance.

5.4.3 Specific Controls or Restrictions

The following action statements are implemented when the associated SC-3 SSC safety functions are not provided.

NOTE: Surveillance frequency is as specified in Section 1.7 and each surveillance shall be performed within 1.25 of the specified frequency. Use of the 25% grace period does not extend the due date for the next surveillance period.

APPLICABILITY: To SC-3 SSCs at all times in the BUILDING 991 COMPLEX.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. Failure of an SC-3 SSC in the BUILDING 991 COMPLEX.	1. Perform any compensatory measures defined in Site procedures dealing with the SSC. **AND** 2. Repair and restore the failed SC-3 SSC.	As specified in Site procedures. 45 days.
2. REQUIRED ACTION and COMPLETION TIME can not be met in REQUIRED ACTION 2 of CONDITION 1	1. Submit an action plan and schedule for SC-3 SSC restoration to the DOE-RFFO if the system is expected to remain failed for up to and including 120 days. **OR** 2. Submit a JCO for having the failed system to the DOE-RFFO if the system is expected to remain or remains failed for more than 120 days.	45 days from the time of entry into CONDITION 1. 45 days from the time of entry into CONDITION 1 if CONDITION 2, REQUIRED ACTION 1 is not performed; 120 days from the time of entry into CONDITION 1 if CONDITION 2, REQUIRED ACTION 1 is performed.

NOTE: The action plan developed in CONDITION 2, REQUIRED ACTION 1 shall (1) characterize the deficiency, (2) state the effect of the deficiency on the FSAR-required safety function, (3) address the collective significance of the deficiency with other existing facility conditions (*e.g.*, current JCOs, discovery issues, other equipment with degraded safety functions), (4) define actions that have been taken to ensure and maintain a safe facility configuration, (5) provide the repair strategy and schedule in sufficient detail to establish critical path milestones (*e.g.*, receipt of replacement parts, vendor availability). Action plans will only be used for routine maintenance.

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Table 2 Maintenance of SC-3 SSCs Credited in FSAR Analysis

Safety SSC	Safety Function	Acceptance Criteria
Automatic Sprinkler System	The SC-3 function provides protection of personnel and equipment in non-waste storage areas of the building.	Specified in SURVEILLANCE REQUIREMENTS for LCO 3.1.
Fire Phones	The fire phones provide a DEFENSE-IN-DEPTH safety function in the analysis for postulated accident scenarios (Facility Fires 1-4, Facility Explosions). The safety function of the fire phones is to provide an alarm (fire bells inside the building) to notify personnel inside Building 991 of a fire.	Verify fire phones transmit to the Central Alarm Station (CAS) and Fire Dispatch Center (FDC) *once per year* per NFPA 72. Verify fire phones activate inside fire bells *once per year* per NFPA 72.
Water Gong Alarm	The water gong alarms provide a DEFENSE-IN-DEPTH safety function in the analysis for postulated accident scenarios (Facility Fires 1-3, Spill 2, Facility Explosion). The safety function of the water gong alarms is to provide an alarm indicating activation of the automatic sprinklers and notifying personnel immediately outside of Building 991 of a fire.	Specified in SURVEILLANCE REQUIREMENTS for LCO 3.1.
LS/DW System	The LS/DW system provides a DEFENSE-IN-DEPTH safety function in the analysis for postulated accident scenarios (Facility Fire 3, Spills 1 & 2, Puncture 1, Container Explosion, Facility Explosion). The safety function of the LS/DW system is to provide notification to building occupants in the event of fire, airborne contamination, and Site or building emergency response activities.	Verify audibility of the system in all areas throughout the BUILDING 991 COMPLEX *once per year*. The *once per year* requirement can be implemented by testing one-twelfth of the building *once per month*.

5.5 EMERGENCY RESPONSE

5.5.1 Requirements for Emergency Response

A program shall be established, implemented, and maintained for emergency response.

5.5.2 CREDITED PROGRAMMATIC ELEMENT

The program shall include an approved Building Emergency Response Operations procedure.

5.6 SAFETY MANAGEMENT PROGRAMS

5.6.1 Requirements for Safety Management Programs

The Safety Management Programs (SMPs), as described and graded in Chapter 3, *Safety Management Programs*, of the FSAR shall be maintained to provide worker protection and DEFENSE-IN-DEPTH safety functions. The SMPs include: Occurrence Reporting, Configuration Management, Nuclear Safety, Fire Protection, Emergency Response, Quality Assurance, Radiation Protection, Safety and Industrial Hygiene, Work Control, Environmental Protection and Waste Management, Maintenance, Training, Organization and Management, Criticality Safety, Records Management and Document Control, and Transportation.

5.7 FIRE PROTECTION

5.7.1 Requirements for Fire Protection

A Fire Protection program ensures that fire protection controls are implemented.

5.7.2 CREDITED PROGRAMMATIC ELEMENTS

The Fire Protection program shall include the following CREDITED PROGAMMATIC ELEMENTS:

1. A BUILDING 991 COMPLEX specific combustible control program shall be developed to define acceptable combustible material area loading and a process to remediate any areas found to contain excessive combustible material loading.
2. Spark, heat, or flame-producing work shall be conducted in accordance with Site procedures.
3. Fire watches shall be implemented in accordance with Site procedures.
4. The Fire Department shall be available to respond to fires in the BUILDING 991 COMPLEX.

5.7.3 Specific Controls or Restrictions

The BUILDING 991 COMPLEX fire extinguishers shall be operational in accordance with NFPA standards.

APPLICABILITY: At all times for fire extinguishers in the BUILDING 991 COMPLEX waste storage areas.

ACTIONS:

CONDITION	REQUIRED ACTION	COMPLETION TIME
1. A BUILDING 991 COMPLEX fire extinguisher is not operational.	1. Contact Fire Department to have fire extinguisher replaced.	4 hours.

5.8 WORK CONTROL

5.8.1 Requirements for Work Control

A Work Control program ensures that activities in the facility are conducted in a formal and controlled manner. Work includes operational activities, surveillance, testing, maintenance and construction.

5.8.2 CREDITED PROGRAMMATIC ELEMENTS

The Work Control program shall include the following CREDITED PROGAMMATIC ELEMENTS:

1. Work shall be performed using approved work instructions/ procedures.
2. A daily facility work planning and approval meeting shall be conducted.
3. Pre-Evolution Briefings shall be conducted.
4. Work controls shall be implemented to ensure hazards remain separated from hazardous materials.

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5.9 CONFIGURATION MANAGEMENT

5.9.1 Requirements for Work Control

The Configuration Management program ensures that SC-1/2 and SC-3 SSCs (including Design Features) are subject to configuration change control.

5.9.2 CREDITED PROGRAMMATIC ELEMENTS

Safety and technical review and validation of design modification work on or potentially impacting SC-1/2 and SC-3 SSCs shall be performed before approval and implementation of the design.

5B.0 GENERAL APPLICATION BASES

ACs 5.0.1 through 5.0.5 establish the rules for AC use and application and are applicable to all ACs at all times, unless otherwise stated. Since ACs are primarily for DEFENSE-IN-DEPTH and worker safety, the requirements are not as rigorous and the safety impact of individual failures is not as severe as for engineered system LCOs and SRs. These AC rules are fully consistent with the Applicability LCOs and general SRs and their BASES, which are provided to control LCOs and SRs for the engineered systems.

AC 5.0.1 establishes the requirement that ACs are to be met at all times. Each AC is divided into two distinct requirement sections. All ACs will have CREDITED PROGRAMMATIC ELEMENTS. Certain ACs will contain specific controls or restrictions consisting of limits and controls that have associated action statements. The manner in which the ACs are met is defined by either specific controls or restrictions with an associated action statement or by adherence to CREDITED PROGRAMMATIC ELEMENTS.

ACs 5.0.2 through 5.0.4 establishes the rules under which failures in AC programs progress from the level of individual failures of CREDITED PROGRAMMATIC ELEMENTS or failure of specific controls or restrictions through to VIOLATION of the AC.

CREDITED PROGRAMMATIC ELEMENTS is a defined term relating to programmatic elements that are credited for controlling the progression of an accident scenario. These elements minimize the potential frequency or consequence of an accident scenario. They are reflected in assumed operational aspects that impact base frequency or available hazardous material assumptions. Controls or restrictions relate to aspects of operation that limits the frequency or consequence of an accident scenario. These latter conform to the limits of the analysis (e.g., total material-at-risk in a facility available for involvement in a seismic event or maximum amounts of material-at-risk allowed in certain containers or locations).

5B.0 General Application BASES (continued)

The rules regarding CREDITED PROGRAMMATIC ELEMENTS contain a three tiered control structure consisting of individual failures, programmatic deficiencies, and AC VIOLATION. Adequate implementation of programmatic elements is the responsibility of facility management who must be able to demonstrate that programmatic compliance is achieved at all times. Individual failures are used as a measurement of adequate program implementation and should be tracked at some level by facility management. Upon occurrence of an individual failure, it is the responsibility of facility management to ensure a safe facility configuration. The safety significance of individual failures will be assessed through the site infrastructure program for Occurrence Reporting coupled with the requirements of the Unreviewed Safety Question (USQ) process in assessing Occurrences Reports for DISCOVERY conditions. When individual failures are determined to be systemic in nature, the adequacy of the program implementation comes into question and corrective measures must be taken. Failure to take appropriate corrective measures will lead to a programmatic deficiency and continued failure to correct the problem will lead to AC VIOLATION.

Failure to meet the action statements for the specific controls or restrictions will lead directly to VIOLATION of the AC.

Upon the occurrence of an AC VIOLATION, safe facility configuration must be assured but may not require the suspension of operations. As these are programmatic requirements, the severity of response will depend on the individual VIOLATION and its impact on operations. This assessment is the responsibility of facility management.

AC 5.0.5 establishes the compliance requirement for ACs relative to OUT OF COMMISSION equipment or areas.

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5B.1 ORGANIZATION AND MANAGEMENT BASES

5B.1.1 Requirements for Organization and Management BASES

The establishment and maintenance of a minimum staff provides assurance that the facility is capable of operating within the controls defined in the TSRs at all times. Clearly defined lines of authority, responsibility, and communication establish command and control within the facility, accountability for safe operation, and definition of the relationship between support functions important to safety and line management.

5B.1.2 CREDITED PROGRAMMATIC ELEMENTS BASES

a. Documenting lines of authority, responsibility, and communication within the facility establishes a formal command and control structure necessary for safe operation. Management and operating personnel accountabilities are defined, decision-making authority is established, and support organization roles and reporting relationships to line management are formalized. Multiple forms of documentation may be utilized, including organizational charts, functional descriptions of departmental responsibilities and relationships, or job descriptions of key personnel positions. Documentation is updated whenever organizational changes are of sufficient significance to modify the command and control structure.

b. The minimum staff defines, by position and number, those management and operating personnel that are necessary for facility safety. Minimum staffing assures that qualified personnel are available to provide the expertise and decision-making capability required to operate the facility within the analyzed safety envelope.

5B.1.3 Specific Controls or Restrictions

1. RCT support shall be provided as required by the Radiological Work Permit whenever BUILDING 991 COMPLEX SNM or waste handling activities occur or whenever storage/facility maintenance operations requiring a RCT are performed.

2. The Facility Manager or designee shall be on duty whenever SNM or waste handling activities occur or whenever storage/facility maintenance operations that could effect the safety envelope are performed.

3. The Facility Manager or designee shall be on call during non-working hours.

4. Criticality Safety personnel shall be on call at all times for response to and assessment of incidents or discovered conditions involving fissile material.

5. The Site Fire and Emergency Services Department shall be available for response 24-hours per day every day of the year to prevent fires and minimize loss to life, material and property in the event of a fire in the BUILDING 991 COMPLEX.

BASIS: The minimum staffing requirements ensure that sufficient resources are available to fulfill credited safety operations. Four hours is considered sufficient time for the facility to restore minimum staffing requirements or make appropriate notifications within the facility and to the Site Shift Superintendent. Four hours is also considered sufficient time to terminate affected operations and place the facility in a safe configuration.

The Site Fire and Emergency Services Department is essential for nuclear and life safety at the Site. The BUILDING 991 COMPLEX relies on the Fire Department to minimize material at risk involvement in the event of an accident involving a fire. The safety analysis in NSTR-011-98 does not specifically credit the Site Fire Department since the size of the fires analyzed inside Building 991 (i.e., 1 MW and 2 MW fires) would be expected to self-extinguish prior to response from the Fire Department. For the fires analyzed to occur under the West Dock Canopy, it was assumed that personnel would not notice the fire and report it to the Fire Department in a timely manner. Since a prompt Fire Department response could mitigate the effects of a fire in the BUILDING 991 COMPLEX, the Fire Department was credited as discussed in Chapter 5 of the FSAR. Four hours is considered sufficient time for the facility to terminate all hot work in the facility and to terminate affected operations and place the facility in a safe configuration.

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5B.2 INVENTORY CONTROL AND MATERIAL MANAGEMENT BASES

5B.2.1 Requirement for Inventory Control and Material Management BASES

Inventory Control and Material Management provides control for the location, storage configuration, and handling of NUCLEAR MATERIAL within the building based on the quantity, type, and form. This element protects the initial source term assumptions of the accident analysis that limit the amount of MAR available for potential release in the event of an accident.

5B.2.2 CREDITED PROGRAMMATIC ELEMENTS BASES

Since there is no specific SMP for Inventory and Material Control, these elements comprise an adequate program as derived from the results of the accident analysis.

a. This element protects the initial source term assumptions of the accident analysis that limit the amount of MAR available for potential release in the event of an accident.

b. By adhering to Site accepted container standards for NUCLEAR MATERIAL packaging, the amount of MAR is minimized through the containment provided by the drum or storage container. This element controls the consequences of a fire both to the worker and the non-worker and assures that if a container is dropped, its integrity will be maintained.

c. Damaged or degraded containers may not confine NUCLEAR MATERIAL adequately to minimize the consequences in the event of a drum failure. Therefore, visual inspections of the exterior surfaces of the container (e.g., no noticeable signs of bulging or damage such as indentations, punctures, or leakage) are performed to identify any significant degradation of container integrity that could lead to a release of radiological material. This early detection limits the potential of a catastrophic failure and controls the hazard to which the worker may be exposed. Visual detection may take place upon receipt, prior to movement, or periodically during area tours and surveillances to confirm the integrity of primary confinement and to provide for early detection of confinement degradation.

d. Container venting relieves excess pressure, and limits explosive gas concentrations. This prevents a rupture of the drum lid seal that could potentially lift the drum lid and result in the release of radioactive material. The credited drum venting is performed using the Site-wide drum-venting program. Drum venting limits the concentration of flammable gasses in the drum which limits the frequency of the accidents that credit the drum vent being installed. The 55-gallon drums are verified to have a vent installed upon receipt in the building, which also reduces the frequency of the event.

5B.2.3 Specific Controls or Restrictions

AOL 1 BASIS: The terms "POC container" and "waste container" will be used in the following discussion to signify containers that meet on-site transportation specifications. The terms also signify POC and waste container integrity. That is, POC and waste containers that have lost integrity (*e.g.*, punctured, rusted, or significantly damaged) do not meet the intent of the AOL. This AOL applies to POC and waste containers that are to be stored in the BUILDING 991 COMPLEX.

POC containers are credited in the FSAR Safety Analysis with the following attributes:

- Cannot be breached by falls from any heights expected during operation;
- Cannot be breached by material handling equipment impacts expected during operation;
- Are *unlikely* to be breached by structural member impacts;
- Cannot be breached by any external flammable gas explosions expected during operation;
- Are *extremely unlikely* to be breached by forklift tine impacts;
- Cannot be breached by any potential internal hydrogen explosions; and
- Cannot be breached by any external fires expected during operation other than direct torch flame impingement.

Metal waste containers are credited in the FSAR Safety Analysis with the following attributes:

- Cannot be breached by falls of less than four feet;
- Are *unlikely* to be breached by material handling equipment impacts expected during operation;
- Are *unlikely* to be breached by forklift tine impacts;
- Cannot lose container lids due to internal overpressure from exposure to expected fires;
- Will not propagate fires from container to container when exposed to expected fires; and
- Cannot be breached by an external explosion peak overpressure of less than 22 psig (55-gallon drums).

Wooden waste crates are credited in the FSAR Safety Analysis with the following attributes:

- Have sufficient integrity to prevent direct exposure of fires to container contents for expected fires; and
- Contents are packaged using an internal, wooden waste crate liner.

AOL 1 BASIS (cont'd)

POC and waste containers are credited in the evaluation of postulated facility fire, spill, puncture, container explosion, facility explosion, and criticality accident scenarios.

In order to restrict non-compliant POC or waste containers that either do not meet the standard container requirements or have lost integrity from the BUILDING 991 COMPLEX, verification of every container brought into the facility for compliance with the requirement is specified. The compliance verification can occur at time of receipt or at the container originating facility prior to shipment by examination of container paperwork and visual examination of container integrity. In addition, a general verification of container integrity is specified for identification of non-compliant POC and waste containers during facility operations and tours. This latter verification is only expected to detect gross failures of containers (i.e., large rust areas, large holes, leakage or spills, bulging, lid loss) and to examine containers while personnel pass through the waste container storage area or perform activities in the waste container storage area.

Container segregation means separation of the non-compliant container from other containers. The separation is expected to be five or more feet, if possible, to prevent container interaction. If a waste container integrity loss results in an emergency situation, segregation of the container is subject to the requirements imposed by the emergency response personnel.

AOL 2 BASIS:

The term "SNM container" will be used in the following discussion to signify containers that meet Type B shipping container certification (includes meeting the requirements of procedure 1-W89-HSP-31.11). This AOL applies to SNM containers that are to be staged in the BUILDING 991 COMPLEX.

SNM containers are credited in the FSAR Safety Analysis with the following attributes:

- Cannot be breached by falls from any heights expected during operation;
- Cannot be breached by material handling equipment impacts expected during operation;
- Are *unlikely* to be breached by structural member impacts;
- Cannot be breached by any external flammable gas explosions expected during operation;
- Are *extremely unlikely* to be breached by forklift tine impacts; and
- Cannot be breached by any external fires expected during operation other than direct torch flame impingement.

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AOL 2 BASIS (cont'd)

In addition, the FSAR Safety Analysis made the following assumption dealing with SNM containers:

- Cannot be impacted by activities other than the "Receipt, Staging, and Shipment of Special Nuclear Material" and the "Surveillance" activities due to their staging location and safeguards restrictions (*i.e.*, only staged in vaults).

SNM containers and SNM container location are credited in the evaluation of postulated material fire, facility fire, spill, puncture, facility explosion, and criticality accident scenarios.

In order to restrict SNM containers that do not comply with Type B shipping container certification from the BUILDING 991 COMPLEX, verification of every container brought into the facility for compliance with the requirement is specified. The compliance verification can occur at time of receipt or at the container originating facility prior to shipment by examination of container paperwork. In addition, a general verification of container staging location is specified for identification of SNM containers that may be located outside of vaults during facility operations and tours. This latter verification is not an accountability verification (*i.e.*, not a verification that the SNM containers are all accounted for in a vault) but occurs as operations and tours are conducted in the facility. Also, this latter verification is not expected to ever find SNM containers outside of a vault due to the safeguards restrictions associated with SNM container location and movement.

<u>AOL 3 BASIS:</u>

The term "metal waste container" will be used in the following discussion to signify waste containers that have the potential to have hydrogen gas generated by radiolysis within the container. The term does <u>not</u> apply to LLW (Ref. A-5), SNM or POC containers. This AOL applies to metal waste containers that are to be stored in the BUILDING 991 COMPLEX.

The rate of hydrogen generation in a container is dependent on the type of material in the container (*i.e.*, defined by the container Item Description Code) and the radioactive material loading of the container. Sealed containers with vents can still accumulate hydrogen if the vents become plugged. The likelihood of vent plugging is also dependent on the type of material in the container. TRU waste containers received at the BUILDING 991 COMPLEX are not expected to have significant vent plugging due to the restrictions on liquids in the containers and the prohibition of TRU-mixed waste containers (prohibition by implication and scope of FSAR Safety Analysis).

The FSAR Safety Analysis made the following assumptions dealing with metal waste containers:

- Are *extremely unlikely* to be breached by internal hydrogen explosions due to container venting.

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AOL 3 BASIS (cont'd)

Metal waste container vents are credited in the evaluation of postulated container explosion accident scenarios. Although not explicitly credited, the venting of metal waste containers aids in the venting of gases from the containers in response to postulated facility fire accident scenarios, further reducing the likelihood of container lid loss due to external heating.

In order to restrict unvented metal waste containers from the BUILDING 991 COMPLEX, verification of every container brought into the facility for compliance with the requirement is specified. The compliance verification can occur at time of receipt or at the container originating facility prior to shipment by examination of container. In addition, a general verification of metal waste container vents is specified for identification of unvented metal waste containers during facility operations and tours. This latter verification is only expected to examine containers while personnel pass through the waste container storage area or perform activities in the waste container storage area.

Container segregation means separation of the unvented metal waste container from other compliant containers. The separation is expected to be five or more feet, if possible, to prevent container interaction.

<u>AOL 4 BASIS:</u>

The term "high radioactive material container" will be used in the following discussion to signify POC and waste containers that are non-compliant with this AOL. POC and waste containers that are brought to the BUILDING 991 COMPLEX are assayed, prior to receipt, to determine radioactive material loading of the container. This AOL applies to POC and waste containers that are to be stored in the BUILDING 991 COMPLEX.

The FSAR Safety Analysis made the following assumption dealing with LLW containers:

- Contain no more than 0.5 grams (WG Pu equivalent) in metal drums and no more than 3 grams (WG Pu equivalent) in wooden or metal crates.

The FSAR Safety Analysis made the following assumption dealing with TRU waste containers:

- Contain no more than 200 grams (WG Pu equivalent) in metal drums and no more than 320 grams (WG Pu equivalent) in metal boxes.

The FSAR Safety Analysis made the following assumption dealing with POC containers:

- Contain no more than 1,255 grams (WG Pu equivalent) and no more than 200 grams (fissionable material).

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AOL 4 BASIS (cont'd) NOTE:

The FSAR Safety Analysis made the following assumptions dealing with SNM containers which are not part of this AOL requirement:

- Contain 6,000 grams (WG Pu equivalent) of oxide or 2,000 grams (WG Pu equivalent) of metal.

POC and waste container radioactive material loading is credited in the evaluation of postulated facility fire, spill, puncture, container explosion, and facility explosion accident scenarios. Note: SNM container radioactive material loading is credited in the evaluation of postulated material fire and puncture accident scenarios.

WG Pu equivalent radioactive material considers the higher dose consequences associated with accidents involving americium in concentrations greater than that expected from ingrowth due to the decay of ^{241}Pu. The formula for calculating WG Pu equivalency is:

WG Pu equivalency (in grams) = WG Pu (in grams) + 66*Am (in grams)

This formula should only be used for waste containers containing more than approximately 0.3% americium in the radioactive material content. If the radioactive material contains less than 0.3% americium, the americium content is consistent with the natural ingrowth of americium in WG Pu.

In order to restrict highly radioactive material containers from the BUILDING 991 COMPLEX, verification of every POC and waste container brought into the facility for compliance with the requirement is specified. The compliance verification can occur at time of receipt or at the container originating facility prior to shipment by examination of container. In addition, a general verification of POC and waste container radioactive material content is specified for identification of high radioactive material containers during facility operations. This latter verification is only expected to examine container inventories during routine reading of container databases or to examine container inventories when attempting to locate a specific container. This latter verification is not expected to find highly radioactive material content containers due to the numerous checks made before a container is stored in the BUILDING 991 COMPLEX.

Movement of highly radioactive material containers is not exempted from any requirements that may be placed on the containers by Criticality Safety. If the container is infracted under the Criticality Safety Program, removal of the container is subject to the requirements of that program.

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AOL 5 BASIS: This AOL applies to wooden LLW containers that are to be stored in the BUILDING 991 COMPLEX.

The FSAR Safety Analysis made the following assumptions dealing with the location and quantity of wooden LLW containers:

- No wooden crates (LLW or non-radioactive waste) are permitted in internal waste container storage areas (not applicable to Building 984);
- No more than 50 wooden LLW crates may be stored in the West Dock Canopy waste container storage area (does not include empty containers); and
- [implied assumption] Wooden LLW crates are stored in areas with automatic sprinkler system coverage (not applicable to Building 984).

Limits on the quantity and location of wooden LLW crates are credited in the evaluation of postulated facility fire accident scenarios. Some of the requirements resulting from the evaluation of wooden LLW crates fires are not separable from combustible material loading requirements due to the combustible load presented by the wooden crates. For example, it is assumed that the wooden crates will be compliant with NFPA 231 (Ref. A-6) requirements, in accordance with Fire Protection Program requirements, dealing with the placement of combustible materials near facility walls.

In order to assure that wooden LLW crates are within inventory limits in the BUILDING 991 COMPLEX, a weekly verification of the number of wooden LLW crates in the BUILDING 991 COMPLEX is specified. In addition, a general verification of the location of wooden LLW crates is specified for identification of misplaced crates during facility operations and tours. This latter verification is only expected to observe containers while personnel pass through the facilities or perform activities in the facilities.

AOL 6 BASIS: The term "infracted container" will be used in the following discussion to signify SNM, POC, and waste containers that are non-compliant with this AOL. This AOL applies to SNM, POC, and waste containers that are to be stored or staged in the BUILDING 991 COMPLEX.

The FSAR Safety Analysis made the following assumption dealing with TRU waste containers:

- Contain no more than 200 grams (fissile material) in metal drums.

The FSAR Safety Analysis made the following assumption dealing with POC and waste containers:

- Designed and used in a manner to preclude a criticality as long as the containers remains intact.

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AOL 6 BASIS (cont'd)

The FSAR Safety Analysis made the following assumption dealing with Type B shipping containers:

- Designed and used in a manner to preclude a criticality as long as the containers remains intact.

NOTE: The FSAR Safety Analysis implicitly assumed that the Criticality Safety Evaluation (CSE) BSM-631 (Ref. A-7) was implemented as justification that a criticality is incredible. This CSE requires that the assumptions specified in CSE BSM-563 (Ref. A-8) and other evaluations are complied with. The CSE specified, in part: limits on container fissionable material content; restrictions on fissile liquids; restrictions on mechanically compacted hydrogenous waste; restrictions on opening of TRU containers; limits on container stacking height to four tiers; and numerous verifications of container content.

Criticality Safety associated with SNM, POC, and waste containers is credited in the evaluation of postulated material fire and criticality accident scenarios.

In order to restrict infracted SNM, POC, and waste containers from the BUILDING 991 COMPLEX, verification of every SNM, POC, and waste container brought into the facility for compliance with the requirement is specified. The compliance verification can occur at time of receipt or at the container originating facility prior to shipment by examination of container paperwork. In addition, the Criticality Safety Program specifies a periodicity for verification of POC and waste container location and arrangement.

Movement of infracted containers is subject to the requirements of the Criticality Safety Program. Restart of terminated container movements in the vicinity of the infracted container(s) is also subject to the requirements of the Criticality Safety program.

AOL 7 BASIS: The term "upper tier waste containers" will be used in the following discussion to signify pallets of waste containers located on the third or fourth tier of stacked containers. The term does not apply to SNM or POC containers. This AOL applies to waste containers that are to be stored in the BUILDING 991 COMPLEX.

The FSAR Safety Analysis made the following assumption dealing with the configuration of upper tier waste containers:

- Waste containers stacked above the second tier will be banded.

Banding of upper tier waste containers is credited in the evaluation of postulated spill and natural phenomena (*e.g.*, seismic event) accident scenarios.

AOL 7 BASIS (cont'd) In order to assure that upper tier waste containers (3rd and 4th tiers) are banded in the BUILDING 991 COMPLEX, a general verification of the banding is specified for identification of non-banded upper tier waste containers during facility operations and tours. This verification is only expected to observe upper tier waste containers while personnel pass through the facilities or perform activities in the facilities.

AOL 8 BASIS: This AOL applies to POC and waste containers that are to be stored in the BUILDING 991 COMPLEX and waste that may be generated in Building 985. This AOL also applies to SNM containers that are to be staged in the BUILDING 991 COMPLEX. The term "south waste container storage areas" will be used in the following discussion to signify Rooms 134, 135, 147, and 170. The term does not apply to Room 166, Corridor A, Room 300, Corridor B, Building 996, or the north waste container storage areas in Building 991 (*i.e.*, Rooms 140/141, 142, 143, 148, 151, 155, 158, and the hallway north of Room 140/141).

The FSAR Safety Analysis made the following assumptions dealing with container operations controls:

- Filtered exhaust ventilation is available in Rooms 134 and 135 as long as the proper airflow connection to the north waste storage area is maintained. Proper airflow connection consists of:

  1. The airlock doors separating Room 134 from the north waste storage area are open.
  OR
  2.1 The roll-up door between Rooms 134 and 170 is open.
  AND
  2.2.1 The door between Rooms 170 and 140/141 is open.
  OR
  2.2.2 The door between Rooms 170 and 147A is open.

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AOL 8 BASIS (cont'd)

- Waste container receipt and shipment activities only cover movement of containers from a transport vehicle at the Room 170 dock to a staging area in Room 170 or from a staging area in Room 170 to a transport vehicle at the Room 170 dock.
- Stacking of Type B shipping containers in the staging area is prohibited;
- Greater than 2-high stacking of waste containers being received or staged for shipping in Room 170 is prohibited;
- Pyrophoric materials would not be brought into the BUILDING 991 COMPLEX;
- Storage of waste containers in Corridor C and Building 985 is prohibited;
- Type B shipping containers, POC containers, and TRU waste containers will not be opened in the BUILDING 991 COMPLEX; and
- Waste containers to be stored in the BUILDING 991 COMPLEX shall not contain liquids.
- Only POCs shall be stored in Room 166.

Movements of Type B shipping containers or POCs in Rooms 147 and 170 while a Room 170 dock door is opened is not considered an AC VIOLATION. Also, the staging area for Type B shipping containers is considered to be the vault. Two-high stacking of Type B shipping containers may be required for placement in the off-site transport vehicle. This in-process stacking is not considered an AC VIOLATION.

Container operations control is credited in the evaluation of postulated facility fire, spill, container explosion, and criticality accident scenarios.

The Building 991 filtered exhaust ventilation system (FEVS) may only be effective in Rooms 147 and 170 when the Room 170 dock doors are closed and when one of the airflow paths from Room 170 to the north waste storage is present. In order to credit this mitigative feature during the conduct of operations in Rooms 147 and 170, many operations may only be conducted in these areas when the dock doors are closed. Since the receiving and shipping of waste containers requires that a dock door be opened, these activities were assessed assuming that a dock door is open and filtered exhaust ventilation cannot be credited for accident mitigation during the activities. The movement of non-POC waste containers from the transport vehicle to a staging area in Room 170 and from a staging area in Room 170 to a transport vehicle is permitted while a dock door is opened. Movements of non-POC waste containers from Room 170 to a storage or staging location can only be performed with the dock doors closed. Movements of non-POC waste containers within Room 170 for purposes other than receipt or shipment also can only be performed with the dock doors closed. Movements of POCs are not restricted when the dock doors are open.

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AOL 8 BASIS (cont'd)

The Building 991 FEVS is only effective in Rooms 134 and 135 when one of the airflow paths specified in the above assumptions from these rooms to the north waste storage area is present. As long as one of the airflow paths to the north waste storage area is present, the Room 170 dock doors can be open. Therefore, operations in Rooms 134 and 135 are not restricted when the Room 170 dock doors are open.

The restriction on storing waste containers in Building 985 and removing any waste generated in Building 985 within 24 hours of job completion is required to mitigate the effects of HEPA filter bypass leakage. This item was addressed in JCO-991-97.1399-MRA and is due to the fan shaft seals for the 601A and 601B fans. For Building 985 there is no material-at-risk inventory currently available to become involved in an accident that could result in an unfiltered release. This control requires that any waste generated as a result of maintenance work or filter changes must be removed from the building to an approved waste storage area within 24 hours of job completion.

The restriction on storing waste containers in Corridor C is based on life safety issues with the structural integrity of the corridor. This restriction is required to limit the time that personnel have to spend in the corridor. Since this restriction is based on life safety issues, storage of waste containers is also not permitted in Building 997 and Building 999 since access to these buildings can only occur via Corridor C.

In order to restrict non-compliant waste containers that contain liquids with hydrogen generation and vent plugging potential from the BUILDING 991 COMPLEX, verification of every container brought into the facility for compliance with the requirement is specified. A waste container is considered non-compliant with this requirement if the quantity of liquids in the waste containers exceeds that normally allowed by packaging requirements (i.e., up to 1% free liquids or 4 liters for a 55-gallon drum). The compliance verification can occur at time of receipt or at the container originating facility prior to shipment by examination of container paperwork. In addition, a general verification of container compliance is specified for identification of non-compliant SNM, POC, and waste containers during facility operations and tours. This latter verification is only expected to observe container locations and arrangements while personnel pass through the waste container storage area or perform activities in the facility.

Container segregation means separation of the non-compliant container from other containers. The separation is expected to be five or more feet, if possible, to prevent container interaction.

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AOL 8 BASIS (cont'd)

Room 166 is susceptible to facility explosions caused by a natural gas leak. The POC is not expected to be breached due to an explosion of this type. Restricting Room 166 to POC storage reduces the potential for a radioactive material release due to a natural gas explosion.

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5B.3 CONTROL OF COMBUSTIBLE MATERIALS AND IGNITION SOURCES BASES

5B.3.1 Requirement for Control of Combustible Materials and Ignition Sources BASES

Maintaining control and verification of combustible materials and ignition sources reduces both the potential for fire in the facility and its consequences. Should a fire be initiated, proper management of combustible materials assures that propagation to unanalyzed quantities of MAR will not occur. Additionally, limiting the available amount of fuel controls fire size and eliminates the potential for flashover.

Solid combustible materials that are stored in metal containers and combustible/flammable liquids stored in accordance with Site standards are protected combustibles, and are therefore exempted from this control.

5B.3.2 CREDITED PROGRAMMATIC ELEMENTS BASES

a. Fire propagation is controlled when appropriate spacing is maintained between:
   - combustible packages,
   - a combustible package and available MAR,
   - a combustible package and vulnerable fire barriers.

b. Spark, heat, or flame-producing work is the principal initiator of fire within the facility. Controlling hot work assures that combustible materials and MAR are reduced or appropriately protected, and that personnel are adequately trained to safely perform the work (including Fire Watches). Should a fire occur, first responders are available to minimize and control the event. The Site Fire Department is adequately staffed and equipped to respond with credited capability.

c. Fire propagation is controlled and the potential for flashover is eliminated when combustible package sizes are appropriately established and maintained.

d. Requiring corrective action implementation commensurate with safety concern findings ensures that conditions will not go without adequate attention.

5B.3.3 Specific Controls or Restrictions

<u>AOL 9 BASIS:</u> This AOL applies to the following "applicable areas":

- Waste container storage areas in the BUILDING 991 COMPLEX (*i.e.*, Building 991, Building 996, and Building 998 waste container storage areas);
- The BUILDING 991 COMPLEX Office Area;
- The West Dock Canopy Storage Area;
- The East and West Docks (for transport vehicles only); and

Building 991 interior areas contiguous to waste container storage areas without rated fire barriers between.

A major premise of the FSAR Safety Analysis is that only moderate size fires will occur in the waste container storage areas. In order to support this premise, the facility must implement a stringent combustible material control program. This is necessary in the waste container storage areas, particularly those storage areas that are not covered by the Automatic Sprinkler System. The only combustibles, other than waste container contents, that are assumed to be located in waste container storage areas are drum-protecting plywood sheets between drum tops and metal pallets in stacked drum configurations, crate-protecting plastic covers between stacked metal crates, and limited transient combustible materials. Combustibles in on-site approved metal waste containers is <u>not</u> considered to contribute to the combustible loading of the waste container storage area.

The FSAR Safety Analysis made the following assumptions dealing with combustibles and ignition sources:

- A combustible material and ignition source control program shall be implemented to make fires in areas containing staged, stored, or in-process radioactive material *unlikely* events;
- Elements of combustible material control include:
  - High heat release rate combustible material restrictions;
  - No wooden crates in internal waste container storage areas; and
  - Combustibles have five foot separation from waste containers and transport vehicles;
- Elements of ignition source control include:
  - Restrictions on smoking in facilities; and
  - Hot work permits.

Flammable materials in on-site approved shipping containers are permitted on transport vehicles loading/unloading at the BUILDING 991 COMPLEX.

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AOL 9 BASIS (cont'd)

Combustible material and ignition source control is credited in the evaluation of postulated facility fire accident scenarios.

Storage of flammable gas containers is considered to constitute any flammable gas containers left in a radioactive waste storage area after a maintenance or construction work order has been fully completed. While work is in-process, safety considerations for leaving flammable gas containers in the BUILDING 991 COMPLEX will be followed (e.g., flammable gas containers shall not be left in radioactive waste storage areas overnight but may be left in non-waste storage areas) to facilitate prompt set-up for the in-process work the following work day. Flammable gas containers may be left unattended in radioactive waste storage areas for short periods of time (e.g., lunch breaks) providing that requirements of the hot work permit are complied with.

In order to assure that combustible materials and ignition sources are controlled in the BUILDING 991 COMPLEX, a general verification of the combustibles and conduct of work is specified for identification of non-compliant conditions during facility operations and tours. This verification is only expected to observe conditions while personnel pass through the facilities or perform activities in the facilities.

In order to assure that the combustible material and ignition source control programs are compliant with the requirements, a monthly verification of the programs in the BUILDING 991 COMPLEX is specified. A monthly surveillance of the combustible material and ignition source control programs is considered adequate due to the low combustible loading in the complex and since the operations normally conducted in the complex do not introduce combustible materials.

AOL 10 BASIS

The FSAR Safety Analysis made the following assumptions dealing with flammable gas containers and use:

- Flammable gas containers are *unlikely* to be breached during use;
- Propane and other flammable gases are prohibited from vaults while SNM is present;
- Work controls are required to ensure that waste container direct exposure to propane or other flammable gas flames is an *extremely unlikely* event;
- The use of flammable gas in Room 135, Room 142, Room 143, Room 147, Room 148, Room 158, and Building 996 is prohibited; and
- The flammable gas inventory in any given waste storage area (i.e., Room 134, Room 140/141/153, Room 151, Room 155, Room 166, Room 170, and Building 998) shall be limited to 150 cubic feet. The number of containers to reach this volume in any given waste storage area, or the number of waste storage areas with flammable gas at any one time, is considered to be within the bounds of the safety analysis.

AOL 10 BASIS (cont'd)

Flammable gas container and use control is credited in the evaluation of postulated facility fire, facility explosion, and criticality accident scenarios.

In order to assure that flammable gases are controlled in the BUILDING 991 COMPLEX, a general verification of the containers and conduct of work is specified for identification of non-compliant conditions during facility operations and tours. This verification is only expected to observe conditions while personnel pass through the facilities or perform activities in the facilities.

In order to assure that the flammable gas control program is compliant with the requirements, a monthly verification of the program in the BUILDING 991 COMPLEX is specified. A monthly surveillance of the flammable gas program is considered adequate since operations involving flammable gases are well controlled and infrequently conducted.

This AOL applies to the following "Applicable Areas"

- Waste container storage areas in the BUILDING 991 COMPLEX (*i.e.*, Building 991, Building 996, and Building 998 waste container storage areas).

The following areas are prohibited flammable gas use waste container storage areas

- Room 135, Room 142, Room 143, Room 147, Room 148, Room 158, and Building 996.

The following areas are permitted flammable gas use waste container storage areas

- Room 134, Room 140/141/153, Room 151, Room 155, Room 166, Room 170, Building 998 (Room 300 and Corridor A), and the West Dock Canopy Area.

5B.4 MAINTENANCE AND SURVEILLANCE OF SC-3 SSCS BASES

5B.4.1 Requirement for Maintenance and Surveillance of SC-3 SSCs BASES

A program ensures consistent management of the SC-3 safety functions identified in Table 4. Restoration of the identified safety function may be provided by the means deemed appropriate by facility management based on facility and operations status at the time. Descriptions of the SSCs, safety functions, and systems interfaces may be found in Chapter 5, *Safety Structures, Systems, and Components*, of the FSAR.

5B.4.2 CREDITED PROGRAMMATIC ELEMENTS BASES

a. Maintenance of safety functions assures the continued minimization of risk by providing DEFENSE-IN-DEPTH functions for authorized operations.

b. Periodic verification assures that the status of SC-3 SSC functions is known and risk can be managed appropriately. Periodicity requirements may be identified in programmatic requirements, defined in System Evaluation Reports (SERs), or contained in other engineering technical justification.

c. Post repair inspection and/or acceptance testing following repair assures the availability of the identified safety functions.

d. Control of changes made to SC-3 SSCs ensures that the equipment will continue to provide its intended safety function following any modification or ensures the configuration of the facility is known.

e. Requiring corrective action implementation commensurate with safety concern findings ensures that conditions will not go without adequate attention.

5B.4.3 Specific Controls or Restrictions

BASIS: This AC applies to SC-3 SSCs in the BUILDING 991 COMPLEX identified in Table 3.

The FSAR Safety Analysis considered the following SSCs DEFENSE-IN-DEPTH SSCs:

- Fire Phones are available to allow communication of fires to the Fire Department;
- Water Gong Alarms on exterior of Building 991; and
- LS/DW System in the BUILDING 991 COMPLEX.
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SC-3 SSCs provide DEFENSE-IN-DEPTH and worker safety for postulated facility fire, spill, puncture, container explosion, facility explosion, and criticality accident scenarios.

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5B.5 EMERGENCY RESPONSE BASES

5B.5.1 Requirement for Emergency Response BASES

The Building Emergency Response Operations procedure is credited in the accident analysis to mitigate potential consequences from a spill or release of NUCLEAR MATERIAL.

5B.5.2 CREDITED PROGRAMMATIC ELEMENTS BASES

The approved Building Emergency Response Operations procedure ensures the facility is capable of responding to a spill or release. The procedure provides for the following:

a. Periodic evacuations drills, including identification of egress routes, assembly areas, and personnel accountability;

b. Emergency notification (e.g., LS/DW, two-way radios); and

c. Spill response, including the availability and maintenance of emergency equipment and material.

Specific Emergency Plans will be modified, as necessary, to reflect new and modified activities ensuring adequate plan coverage.

5B.7 FIRE PROTECTION BASES

5B.7.1 Requirement for Fire Protection BASES

The safety analysis places great importance on a combustible material control program to ensure that large fires do not occur in waste container storage areas. Postulated accident scenarios that specify the Fire Protection program include facility fire, facility explosions, and criticalities.

5B.7.2 CREDITED PROGRAMMATIC ELEMENTS BASES

1. Determination of acceptable combustible material loading in various areas and maintaining the facility in compliance with the determination are key elements of the control of combustibles in the facility. Specific controls in the combustible control program are identified in AC 5.3.

2. An ignition source control program accommodates changes occurring in the facility (maintenance, decommissioning, equipment removal, etc.). These changes may require ignition sources (spark/heat/flame producing work) as part of the work package. In order to ensure that ignition sources are controlled in the facility, given the transient nature of many ignition sources, work involving spark/heat/flame producing work will be controlled. This control can take the form of a hot work permit process.

3. LCO 3.1 requires implementation of fire watches during conditions when the Automatic Sprinkler System and Flow/Smoke Detection Alarm Transmittal System is not operable. In order to ensure that fire watches are controlled in the facility, the fire watch will be established in accordance with Site requirements.

4. The Fire Department serves a credited protection function in mitigating fires in the facility. The Fire Department also serves to mitigate facility flooding and water damage due to actuation of the Automatic Sprinkler System. The loss of this function tends to increase the likelihood of large fires in the fire analysis.

5B.7.3 Specific Controls or Restrictions

BASIS: The fire extinguishers prevent a small fire from propagating into a large fire in the waste container storage areas. The fire extinguishers are credited in Facility Fire Scenarios 1 through 4. The temporary loss of a fire extinguisher (i.e., from the time the Fire Department is notified until the fire extinguisher is replaced) within the waste storage areas is not expected to significantly increase the likelihood of a small fire propagating into a large fire. Therefore, no other required actions are specified when a fire extinguisher is found to be out of compliance with requirements.

5B.8 WORK CONTROL BASES

5B.8.1 Requirement for Work Control BASES

Conducting work in a formal and controlled manner helps to minimize the consequences and occurrence of unauthorized work in the facility.

5B.8.2 CREDITED PROGRAMMATIC ELEMENTS BASES

1. Providing an established process to verify that approved work instructions are used for performing work ensures that the performance of the activity associated with the work instruction does not introduce new hazards into the facility and has adequate controls in place to protect the worker.

2. An awareness of all activities to be conducted in the facility at any one time is necessary to avoid activity interactions that may introduce hazards in the facility. By having a facility work planning and approval meeting each day, the likelihood of undesirable activity interactions is reduced. Also, workers are made aware of other hazards in the facility that are not associated with their work which aids in worker protection.

3. By briefing all participants in an activity before performing the activity, personnel are made aware of the hazards, the controls, and the work instructions associated with the activity. This briefing helps to ensure that the work is performed as expected and that appropriate procedures and controls are used in the performance of the work.

4. The FSAR safety analysis assumptions dealing with the likelihood of facility fires, spills, punctures, container explosions, facility explosions, and criticalities are based on operational restrictions in the BUILDING 991 COMPLEX. These operational restrictions ensure that either the likelihood of an accident is minimized or the consequences are reduced and ensure consistency with safety analysis assumptions.

5B.9 CONFIGURATION MANAGEMENT BASES

5B.9.1 Requirement for Configuration Management BASES

The safety analysis of the FSAR makes assumptions about the configuration and operation of SC-1/2 and SC-3 SSCs. The configuration of this equipment is maintained to ensure that FSAR assumptions are valid. The hazard evaluation of the BUILDING 991 COMPLEX assumes that the current configuration of identified hazard/energy sources is maintained to ensure that hazards: (a) remain separated from hazardous material; (b) remain remote from CW and public; (c) remain relatively low temperature; (d) remain relatively low pressure; and (e) remain separate from radioactive material.

5B.9.2 CREDITED PROGRAMMATIC ELEMENTS BASES

The safety and technical review process for design modifications on or potentially impacting SC-1/2 and SC-3 SSCs ensures that the SSCs will continue to perform their credited and/or intended functions after modification of equipment in the BUILDING 991 COMPLEX. This maintains the facility safety basis even though SC-1/2 and SC-3 SSC-impacting modifications are planned.

6 DESIGN FEATURES

The purpose of this section is to list passive DESIGN FEATURES important to safety in the BUILDING 991 COMPLEX. DESIGN FEATURES are passive features that reduce the frequency and/or mitigate the consequences of uncontrolled releases of radioactive or other hazardous materials from the facility to protect the health and safety of the public, collocated workers, or immediate workers. Passive features credited in the accident analyses are discussed in Table 3. Configuration management of DESIGN FEATURES important for safety are addressed in Chapter 3, *Safety Management Programs*, of the FSAR.

Table 3 BUILDING 991 COMPLEX DESIGN FEATURES

DESIGN FEATURE	BASIS
Metal Waste Containers/Drums*	The metal waste containers and drums used for the storage of radioactive waste are required to meet on-site transportation requirements. These containers are relied on in the analysis to: (1) not be breached by falls of less than four feet; (2) resist breaching due to material handling equipment impacts; (3) resist breaches from forklift tine impacts; (4) retain container lid due to internal overpressure from exposure to expected fires; (5) not propagate fires from container to container when exposed to fires; and (6) survive external explosion peak overpressure of less than 22 pounds per square inch gauge (psig) (55-gallon drums). These containers are also expected to provide resistance to breaching from structural failures of the building during natural phenomena hazards and external events (NPH/EE).
Pipe Overpack Containers*	The POCs are required to meet on-site transportation requirements. The POCs are relied upon in the analysis to: (1) not be breached by falls from any heights expected during normal operations; (2) not be breached by material handling equipment impacts; (3) resist breaches by structural member impacts; (4) not be breached by external flammable gas explosions; (5) resist breaches by forklift tine impacts; (6) not be breached by internal hydrogen explosions; and (7) not be breached by external fires expected during operations other than by direct torch flame impingement. The POCs are also expected to provide resistance to breaching from structural failures of the building during natural phenomena hazards and external events (NPH/EE).
Type B Shipping Containers*	The SNM Type B shipping container is required to meet Type B shipping container certification. These containers are relied upon in the analysis to: (1) not be breached by falls from any heights expected during normal operations; (2) not be breached by material handling impacts; (3) resist breaches by structural member impacts; (4) not be breached by external flammable gas explosions; (5) resist breaches by forklift tine impacts; and (6) not be breached by external fires expected during operations other than by direct torch flame impingement.
Building Structure / Internal fire barrier (fire rated wall and fire doors separating office area from Room 134)	The fire barrier, wall and fire doors, that separates the Building 991 office area from the waste storage area (Room 134) was credited with eliminating the potential of a large fire in the office area impacting waste containers in Room 134. The credited portion of the fire barrier is the wall between the Building 991 office area and Room 134, and the fire doors in the hallway between the office area and Room 134.

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Table 3 BUILDING 991 COMPLEX DESIGN FEATURES

DESIGN FEATURE	BASIS
Building Structure / Exterior Walls and Concrete Roofs	The Building 991 structure (exterior walls and roof above waste storage areas) was credited with reducing the possibility that a NPH/EE (i.e., high winds, tornadoes, heavy rain, heavy snow, aircraft crash, or seismic) could impact radioactive waste containers. The building structure is credited with: (1) surviving a design basis earthquake, (2) surviving high winds and tornadoes; (3) surviving wind driven missiles; (4) surviving atmospheric pressure changes; (5) surviving a roof collapse due to heavy rain or heavy snow; and (6) surviving an aircraft crash.
Building Structure / Hallway Floor	The Building 991 structure (hallway floor (Room 153)) was credited with reducing the likelihood that structural failure of the floor could impact radioactive waste containers. The accident types that could result from structural failure of the floor is a radioactive material spill due to container breach.
Compressed Gas Cylinders*	Compressed gas cylinders were identified in the analysis and are relied on to provide confinement (i.e., physical barrier) for flammable materials. Containers brought into the facility are required to meet Department of Transportation (DOT) requirements for compressed gas cylinders. Containers meeting these requirements reduce the possibility that a flammable gas container will fail resulting in a facility explosion that could damage the facility and impact radioactive waste containers.

* SURVEILLANCES and REQUIRED ACTIONS related to these DESIGN FEATURES are covered by the AC that requires this feature.

Any process that might alter, modify, or affect these DESIGN FEATURES shall be evaluated for possible safety impact in accordance with the Site's configuration change control program. Significant impairment of passive DESIGN FEATURES requires immediate initiation of an evaluation in accordance with the Site Corrective Action Program and performance of an USQD.

7 REFERENCES

A-1 *Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, **NFPA 25**, National Fire Protection Association, Quincy, MA, 1995.

A-2 *National Fire Alarm Code*, **NFPA 72**, National Fire Protection Association, Quincy, MA, 1996.

A-3 *Standard for the Installation of Sprinkler Systems*, **NFPA 13**, National Fire Protection Association, Quincy, MA, 1991.

A-4 *Fire Hazards Analysis Building 991 Complex*, **FHA-991-003**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, August 29, 1998.

A-5 *Hydrogen Generation in Low-Level and Low-Level Mixed Waste (LLW/LLMW)*, **CALC-RFP-99.0161-VLP**, Nuclear Safety Engineering Calculation, Rocky Flats Environmental Technology Site, Golden CO, November 23, 1998.

A-6 *Standard for General Storage*, **NFPA 231**, National Fire Protection Association, Quincy, MA, 1995.

A-7 *Criticality Controls in Dedicated Waste Storage Container Areas*, Criticality Safety Evaluation, **BSM-631**, Revision 0, Rocky Flats Environmental Technology Site, Golden, CO, February 23, 1999.

A-8 *Waste Container Storage*, Criticality Safety Evaluation, **BSM-563**, Revision 1, Rocky Flats Environmental Technology Site, Golden, CO, June 18, 1997.

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DOE/RFFO Comment	RMRS Actions Required to Respond to Comment
Appendix A, Directed Changes to the B991 Complex FSAR	
1. Revise the NSTR and FSAR evaluations of the large six-drum fire scenario to specifically credit the automatic sprinklers as both a preventive and mitigative feature.	NSTR and FSAR have been updated to specifically credit the automatic sprinkler system. Reference NSTR (Sections 5.3.2, 5.3.7); FSAR Chapter 5 (Sections 5.2, 5.2.1, 5.3); FSAR Chapter 6 (Section 6.3); and FSAR Appendix A TSRs (LCO 3.1). The update incorporates the approach recommended in Parker letter (99-RF-02409, 6/24/99).
2. Revise the applicable NSTR and FSAR evaluation for Facility Fire 2 and Facility Fire 4 to specifically credit fire alarms (i.e., sprinkler flow alarms or smoke alarms in storage areas without sprinklers) and Fire Department response to mitigate fires larger than those evaluated, and establish appropriate TSRs (i.e., LCOs or ACs and their bases).	NSTR and FSAR have been updated to specifically credit the sprinkler flow alarms, the smoke detector alarms, and the Fire Department response. Reference NSTR (Sections 5.3.3, 5.3.5, 5.3.7); FSAR Chapter 5 (Sections 5.2, 5.2.1, 5.3); FSAR Chapter 6 (Section 6-3); FSAR Appendix A TSRs (LCO 3.1, AC 5.1). The update incorporates the approach recommended in Parker letter (99-RF-02409, 6/24/99).
3. Revise the NSTR, FSAR, and TSR to include the plenum deluge system as defense-in-depth, or provide justification acceptable to DOE why this does not provide significant defense in depth to mitigate potential consequences to the collocated worker and public for fires occurring in filtered areas.	Justification provided in Parker letter (99-RF-02956). The DOE/RFFO provided additional technical direction (verbal) in the August 19, 1999 meeting to incorporate the automatic plenum deluge system into the NSTR and FSAR and the additional justification provided would be reviewed after the FSAR is implemented. Reference NSTR (Section 6); FSAR Chapter 2 (Section 2.3.1.4); FSAR Chapter 4 (Section 4.6); FSAR Chapter 5 (Sections 5.2, 5.2.2, 5.3); FSAR Chapter 6 (Section 6.3); FSAR Appendix A TSRs (LCO 3.3).
4. Instead of qualitatively concluding that a risk dominant event such as seismic collapse bounds the heavy snow event, qualitative or quantitative consequence assessments and assignment of risk classes needs be performed as a condition for approval. If it is determined to be a new risk dominant event, evaluation of feasible controls needs to be performed and a justification for risk acceptability needs to be provided.	Provided qualitative evaluation of the heavy snow event-induced spill. Reference NSTR (Section 5.9.1.1.5, 5.9.4).

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DOE/RFFO Comment	RMRS Actions Required to Respond to Comment
Appendix B, Issues to be Addressed upon Implementation of the B991 Complex FSAR	
1. For risk dominant accident scenarios, feasible additional controls (e.g., segregation of lower risk MAR for storage in unfiltered areas), and justifications acceptable to DOE on why those controls are not being imposed, need to be addressed during implementation of the FSAR, similar to how this is discussed in other recently approved ABs at the Site (e.g., 371/374, 776/777, and draft 707 BIO). For example, • Building 776 and Building 707 have limited the size of acetylene cylinders to "pony packs", which lowered the risk to the Immediate Worker to a Risk Class III event and would not longer be a risk dominant event. • Complete an evaluation for upgrading the ventilation system in the south storage areas. This evaluation should determine the risk benefit (e.g., by crediting the filtered exhaust system can we eliminate any risk dominant scenarios) taking into account the mission life of the facility and the cost of upgrading the system. This evaluation should be completed within 30 days and submitted to RFFO. However, this evaluation does not need to be incorporated into the FSAR until implementation. • Evaluate how the facility can further reduce the risk by crediting the ventilation system in the north areas and storing the higher risk drums in this area. This evaluation should be completed within 30 days and submitted to the RFFO. However, this evaluation does not need to be incorporated into the FSAR until implementation	• Incorporated the B776/777 BIO methodology for qualitatively determining dose consequences to the IW, therefore the facility explosion accident scenario was reduced to Risk Class III from Risk Class II for the IW. A blended solubility class was determined appropriate for this accident scenario based on K-H direction (Reference letter AMP-236-99). Since the facility explosion accident scenario did not present a high risk (Risk Class I or II) to any receptor, use of "pony packs" for accident risk reduction was not evaluated. • An engineering evaluation of the B991 exhaust filtration system was completed and determined to be adequate. Therefore, this system has been credited. Reference NSTR (Section 6, Risk Dominant Accident Scenario); FSAR Chapter 2 (Section 2.3.2.2); FSAR Chapter 4 (Risk Dominant Accident Scenario); FSAR Chapter 5 (included as a SC-1/2 SSC); FSAR Chapter 6; FSAR Appendix A TSRs (LCO 3.2, AC 5.2 AOL 8).

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DOE/RFFO Comment	RMRS Actions Required to Respond to Comment
Appendix B, Issues to be Addressed upon Implementation of the B991 Complex FSAR	
2. During the IVR verify that procedures and operating practices do not permit blocking the fire doors open when drum movements or material handling to the East Dock are necessary (e.g., for forklift traffic or movement of a large number of drums with drum dollies).	IVR item, no changes to NSTR or FSAR required.
3. The contractor should modify Chapter 5 and make the linkages consistent between System Categories, Safety Class, and Safety Significant, based on guidance to be developed by K-H and the COEM or other appropriate K-H documents. Also Chapter 6 and AC 5.4 should be reviewed to determine if any changes are needed as a result of modifying/clarifying Chapter 5.	Chapter 5 has been modified. The discussion on system categories (Site methodology) and safety class/significant (DOE-STD-3009 methodology) has been separated since the two methodologies currently do not correlate. K-H is developing a standardized methodology that will be incorporated into all appropriate ABs. The B991 Complex FSAR will incorporate this methodology at the next annual update.
4. During the IVR, verify that the implementing procedures for TSR AC 5.4 surveillance of the exhaust plenum systems have incorporated appropriate surveillance requirements on the automatic and manual deluge systems, and HEPA filters as a result of the HEPA Filter Service Life implementation plan.	LCO 3.3 added with associated surveillance requirements. No manual deluge system flow testing required due to filter wetting issues.
5. During the IVR, evaluate the robustness of the Combustible Control and Ignition Source Control Programs.	IVR item, no changes to NSTR and FSAR required.
6. During the IVR, verify the window in Room 166 is adequately sealed.	The window in Room 166 does not have to be covered and sealed since there is a control to only store POCs in that room. The Room 166 window only had to be covered and sealed if POCs were not going to be stored in the room. The FSAR Appendix A TSRs were updated to eliminate any reference to or requirement for the window covering.

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DOE/RFFO Comment	RMRS Actions Required to Respond to Comment
Appendix B, Issues to be Addressed upon Implementation of the B991 Complex FSAR	
7. Table 6-2 specifies that "Type B containers contain no more than 6000 grams (WG Pu equivalent) of oxide" and links this requirement to AC 5.2, AOL 4, which implements it. However, AOL 4 doesn't list this requirement. Table 6-2 and AOL 4 must be modified as necessary to make the assumptions of the accident analysis and the control set consistent.	The assumption has been reworded to indicate that this is an assumption of the safety analysis. Reference NSTR (Section 5.5.3, 7); FSAR Chapter 4 (Section 4.8).
8. A discrete control should be added to the AC section of the TSRs for the fire extinguishers since they are credited and are classified as Safety Significant.	Discrete control added to AC 5.7, Fire Protection.
9. The AC section of the TSRs must be revised to include Administrative Controls for the following programs: Fire Protection, Work Control, and Configuration Management. The key attributes of these programs identified in Table 4-7 must be included in these ACs.	AC 5.7, Fire Protection; AC 5.8, Work Control; and AC 5.9, Configuration Management added to the FSAR Appendix A TSRs.
10. Section 5.1.3 of the TSRs specifies the controls or restrictions for minimum staffing levels. This section requires the Facility Manager or designee to be on duty whenever SNM and waste handling activities occur or whenever storage/facility maintenance operations are performed. This statement can be interpreted that the Facility Manager or designee must be present for all maintenance operations even if they don't impact the analyzed safety envelope. This section must be clarified to clearly specify when the Facility Manager must be present.	AC 5.1 updated to indicate that the Facility Manager or designee shall be on duty whenever SNM or waste handling activities occur or whenever storage/facility maintenance operations "that could effect the safety envelope" are performed. This change permits the Facility Manager to make a judgement on those maintenance operations they need be present for.

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DOE/RFFO Comment	RMRS Actions Required to Respond to Comment
Appendix B, Issues to be Addressed upon Implementation of the B991 Complex FSAR	
11. Completion Time for AOL 3, Condition 1, Required Action 2; Completion Time for AOL 3, Condition 2, Required Action 2; and Completion Time for AOL 4, Condition 1, Required Action 3 specify an exact time (e.g., 72 hours) that is consistent with the recent change to the 750 Pad TSRs.	Specific completion times identified for each specified AOL and Condition.
12. AOLs 9 and 10 must specify a surveillance frequency for verifying compliance with the combustible control program and the ignition source control program. The basis section of the TSRs shall be modified to justify the established periodicity and the periodicity should be consistent with other buildings across the Site.	A monthly surveillance frequency has been identified for AOL 9 and AOL 10. The monthly frequency was justified based on the low combustible loading in the complex and since operations normally conducted in the complex does not introduce combustible materials.
13. AC 5.4, Required Action 2.2 must be clarified and state "Submit a Justification for Continued Operations that evaluates the failed SC-3 SSC and obtain the DOE approval."	AC 5.4 updated to add a second condition. The update provided in AC 5.4 is consistent with DOE/RFFO direction received by B371.
14. The B991 FSAR did not fully incorporate the AC Template; however, the AC portion of the TSRs should not be impacted. During the Implementation Validation Review the discrete Administrative Controls and the implementing procedures should be thoroughly reviewed and validated.	IVR item, no changes to NSTR or FSAR required.
15. Prior to the IVR, the contractor must submit their plan to validate the compliance status of the Safety Management Programs.	IRV item, no changes to NSTR or FSAR required.

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DOE/RFFO Comment	RMRS Actions Required to Respond to Comment
Appendix C-1, Comments to be Included in the Annual Update of the FSAR	
1. The contractor identified the Damage Ratio and the likelihood of occurrence were conservative for a radioactive material spill that occurs due to puncturing a Type B container. The contractor should re-evaluate this accident and determine if the risk can be lowered.	Added justification for reducing the likelihood of a Type B or POC puncture to a *Beyond Extremely Unlikely* event. Reference NSTR (Section 5.5.1).
2. Chapters 1 and 2 of the FSAR do not link deficiencies that are discussed to exemptions. The FSAR should be modified and identify and link deficiencies to exemptions when applicable.	OPEN – will add at annual update.
3. Revise the fire event tree analysis to be consistent with the more conservative methodology applied for other BIOs and BFOs recently approved, i.e., the frequency of large fires with success of automatic sprinklers should be *Unlikely*.	OPEN – will add at annual update.
4. Correct the radiological dose calculations for the 1,255 g WG Pu equivalent MAR in a POC puncture using the appropriate Solubility Class, either by calculating the dose contributions from Pu and Am separately, or from an equivalent WG Pu.	NSTR (Section 5.5.2) updated to discuss appropriate Solubility Class to use and dose calculations changed.

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DOE/RFFO Comment	RMRS Actions Required to Respond to Comment
Appendix C-1, Comments to be Included in the Annual Update of the FSAR	
5. Minor editorial changes recommended for the next annual update: • NSTR p.225: Delete sentence on conservatisms that was removed from the Control Set Adequacy/Vulnerability Assessments. • NSTR p.256 & 282: Reference 38 was developed for the Site SAR, but not used for the final analysis approved in the Site SAR – CALC-RFP-98.0570-KKK should be referenced. • NSTR p. 267: Change "sixteen" drums to "six" drums. • NSTR p. 318: Failure of radiation protection or emergency plan mitigative features does not increase the immediate worker risk to Risk Class II (per page 317). • NSTR, p.357: TRU waste is listed for a seismic induced criticality that is *Unlikely* in (7) and *Extremely Unlikely* in (8). • NSTR p.370: Correct the 1.2E-3/yr DBE to 8.11E-4/yr.	OPEN - all editorial changes have been made except for the 2nd and 5th bulleted items. These two items will be addressed at the next annual update.
6. NSTR p.374: Correct the 1.2E-3/yr DBE to 8.11E-4/yr, and the 1.2E-3/yr BDBE to 3.0E-4/yr.	Changes have been made.
7. Tables 4-8 and 6-2 say that Spill Scenario 1 credits banding; however, NPH/EE Scenario 2 also credits banding and should be listed in these tables.	These tables have been updated.

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Building 991 Complex FSAR/NSTR Change Summary
September 15, 1999

	Revisions
Building 991 Complex FSAR Revision 1	
Executive Summary	• Updated to reflect changes made in document.
Chapter 1	• No changes made.
Chapter 2	• Added information concerning current configuration of B991 roof plenum deluge system. Identified testing capability of system. • Provided discussion on configuration of B985 and B991 HEPA filters (when they were installed, replaced, and last wetted). • Updated Figure 2-14 to show 2nd valve (located on B991 roof) that is used to activate the manual deluge system for the plenum.
Chapter 3	• No changes made.
Chapter 4	• Revised IW radiological dose consequences for accident scenarios. We incorporated the approach the recently approved B776/777 BIO used. This approach caused some of our previous IW dose consequence evaluations to change. • Updated discussion to indicate that puncture of POCs and Type B containers is not considered a credible accident scenario. • Added summary for new accident scenario on heavy snow event-induced spill. • Updated Table 4-5 based on changes to NSTR accident scenarios. • Updated Risk Dominant Accident Scenario discussion. Used this section to formally credit the building's filtered exhaust ventilation system. By crediting the filtered exhaust ventilation system and using the B776/777 BIO IW dose consequence approach, the number of risk dominant accident scenarios was reduced from 5 to 3. • Updated Table 4-8 to identify all scenarios for the assumption/feature/requirement. Added requirements to this table.
Chapter 5	• Re-wrote to separate the discussion of system category (SC) SSCs and safety-class/significant SSCs since the Site methodology does not currently correlate with the DOE-STD-3009 methodology. • Added information crediting the automatic fire suppression system, flow alarms and smoke detectors based on their capability to mitigate potential fires larger than those evaluated in the NSTR.
Chapter 6	• Updated to incorporate changes made to FSAR and NSTR. Updated Tables 6-1 and 6-2 to make consistent with FSAR and NSTR.

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	Revisions
Appendix A, TSRs	• Updated Section 1.7 to include additional surveillance frequencies. • Added Smoke Detection to LCO 3.1. Added one condition and required actions and two surveillances. • Updated LCO 3.1 Bases for flow alarms/smoke detection systems. • Added new LCO 3.2 and associated surveillance requirements on the filtered exhaust ventilation systems for the complex since these systems are now credited. Bases explain why conditions/required actions and surveillances are different than for Pu facilities (response to the DOE/RFFO comment). • Added new LCO 3.3 and associated surveillance requirements on the automatic plenum deluge system as directed by the DOE/RFFO. Current testing capability/configuration of system discussed. • Added condition to AC 5.1 for when the Fire Department does not have the minimum staffing required to respond to a fire. • Updated AC 5.2, AOL 3 completion times to make specific. • Updated AC 5.2, AOL 4 completion times to make specific. • Updated AC 5.2, AOL 5 completion time to make specific. • Updated AC 5.2, AOL 8 to include additional administrative controls identified since the filtered exhaust ventilation system is now being credited. • Updated AC 5.3, AOL 9 and AOL 10 to establish a monthly requirement for verifying the combustible material and ignition source control program and the flammable gas use control program. • Updated AC 5.4 to delete those SC-3 SSCs that are now considered SC-1/2 (e.g., smoke detectors and flow alarms). Added new condition 2 based on technical direction provided to B371. • Added new AC 5.7, 5.8 and 5.9 since the AC Template is not being incorporated into this version of the FSAR. • Updated AC Bases based on changes made to ACs. • Updated Design Feature to delete Room 166 window covering (not required since we have another control that only POCs be stored in Room 166). • Updated AC 5.2, AOL 6 surveillance frequency from a "monthly" requirement to "periodically as specified by the Criticality Safety Program".

	Revisions
NSTR-011-98, Safety Analysis for the Building 991 Complex FSAR, Revision 2	
Executive Summary	• Updated to incorporate changes made to document.
Chapter 1	• No changes made.
Chapter 2	• No changes made.
Chapter 3	• Updated to incorporate the B776/777 BIO approach for determining dose consequences to the IW.
Chapter 4	• Updated Table 61 to clarify that the WG Pu equivalent gram loading used for Type B containers is an assumption of the analysis and is not a control that should be specified in the TSRs.
Chapter 5	• Updated appropriate accident scenarios based on new approach for qualitatively evaluating the dose consequences to the IW. • Specifically credited the automatic sprinkler system, flow alarm/fire department response, smoke detectors/fire department response for Facility Fire 2. • Specifically credited the flow alarm/fire department response for Facility Fire 4. • Added Features F26 and F27 for the flow alarms/fire department response and smoke detectors/fire department response. • Updated accident scenario summary tables based on changes to the accident scenarios. • Added discussion to reduce the likelihood of a puncture of a Type B or POC to *Beyond Extremely Unlikely*. • Added discussion concerning the solubility class for the POC puncture evaluation. • Enhanced discussion on number of drums that could be breached from a facility explosion event. • Added accident scenario for a heavy snow event-induced spill. No new controls identified.
Chapter 6	• Updated Risk Dominant Accident Scenario discussion. Used this section to formally credit the building's filtered exhaust ventilation system. By crediting the filtered exhaust ventilation system and using the B776/777 BIO IW dose consequence approach, the number of risk dominant accident scenarios was reduced from 5 to 3.
Chapter 7	• Updated Table 110 to add all scenarios for the applicable assumption/feature/requirement.